

## **780 CMR 3608**

### **ROOF-CEILING CONSTRUCTION**

#### **3608.1 GENERAL**

**3608.1.1 Application:** The provisions of 780 CMR 3608.1 shall control the design and construction of the roof-ceiling system for all buildings. The use of materials or methods of construction not specified in 780 CMR 3608.1 accomplishing the purposes intended with 780 CMR 36 and approved by the building official in accordance with 780 CMR 36 and approved by the building official in accordance with **780 CMR 109** shall be accepted as complying with 780 CMR 36.

**3608.1.2 Requirements:** Roof-ceiling construction shall be capable of **supporting** all loads imposed according to **780 CMR 3603.1** and shall transmit the resulting loads to supporting structural elements.

**3608.1.3 Roof drainage:** In areas where expansive or collapsible soils are known to exist **or where required by city or town ordinance or by-law**, all dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least five feet (1524 mm) from foundation walls or to an approved drainage system.

#### **780 CMR 3608.2 ROOF FRAMING**

**3608.2.1 Identification and grade:** Load-bearing dimension lumber for rafters, trusses and ceiling joists shall conform to DOC PS 20 and to other applicable standards or grading rules, **as listed in Appendix A**, and be identified by a grade mark or certificate of inspection issued by an approved agency. The grade mark or certificate shall provide adequate information to determine  $F_b$ , the allowable stress in bending, and  $E$ , the modulus of elasticity. Approved end jointed lumber may be used interchangeably with solid-sawn members of the same species and grade. Blocking shall be a minimum of utility grade lumber.

**Exception:** *Use of Native Lumber shall be allowed in accordance with 780 CMR 2303.0.*

**3608.2.1.1 Fire-retardant-treated lumber:** The allowable unit stresses for fire-retardant-treated lumber, including fastener values, shall be developed from an approved method of investigation which considers the effects of anticipated temperature and humidity to which the fire-retardant lumber will be subjected, the type of treatment and redrying process. The fire-retardant

treated lumber shall be graded by an approved agency.

**3608.2.2 Design and construction:** Roof-ceilings of wood construction shall be designed and constructed in accordance with the provisions of 780 CMR 3608.2 or with the AFPA NDS-1991 "National Design Specification for Wood Construction," the CWC-1987 "Canadian Dimension Lumber Data Book," the WWPA- 1992 "Western Lumber Span Tables for Floor and Ceiling Joists and Roof Rafters," or the "Southern Pine Maximum Spans for Joists and Rafters," **each as listed in Appendix A**. Roof-ceilings shall be constructed in accordance with Figures **3606.4.10a**, **3606.4.10b**, **3606.4.10c** and **3608.2.4.1** and nailed in accordance with Table **3606.2.3a**.

**3608.2.2.1 Cathedral ceilings:** When ceiling joists and rafter ties are omitted and the rafters are used to create a cathedral ceiling, rafter ends shall be supported on bearing walls, headers or ridge beams. Rafters shall be attached to supporting members in accordance with Table **3606.2.3a**. Ridge beams shall be capable of carrying the imposed roof loads and shall be supported by structural elements which transmit the loads to the foundation.

**3608.2.3 Framing details:** Rafters shall be nailed to ceiling joists to form a continuous tie between exterior walls where joists are parallel to the rafters. Where not parallel, rafters shall be tied with a rafter tie, located as near the plate as practical. Rafter ties shall be spaced not more than four feet (1219 mm) on center. Rafters shall be framed to ridge board or to each other with gusset plate as a tie. Ridge board shall be at least one-inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a valley or hip rafter not less than two-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point.

**3608.2.3.1 Ceiling joists lapped:** Ends of ceiling joists shall be lapped a minimum of three inches (76 mm) or butted over bearing partitions or beam and toenailed to the bearing member. When ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together

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and butted joists shall be tied together in a manner to resist such thrust.

**3608.2.3.2 Collar ties:** Pairs of rafters on opposing sides of a ridge board in roof pitches over three units vertical in 12 units horizontal shall be connected by collar ties. Collar ties shall be located at a maximum spacing of 48 inches on center, measured parallel to the ridge, or at every third pair of rafters, whichever is smaller. Collar ties shall be located in the upper third of the height of the roof, measured from the sill plate to the ridge, and shall be a minimum of one inch by six inch dimension lumber. Collar ties shall be connected to rafters in accordance with the requirements for rafter ties in Table 3606.2.3a.

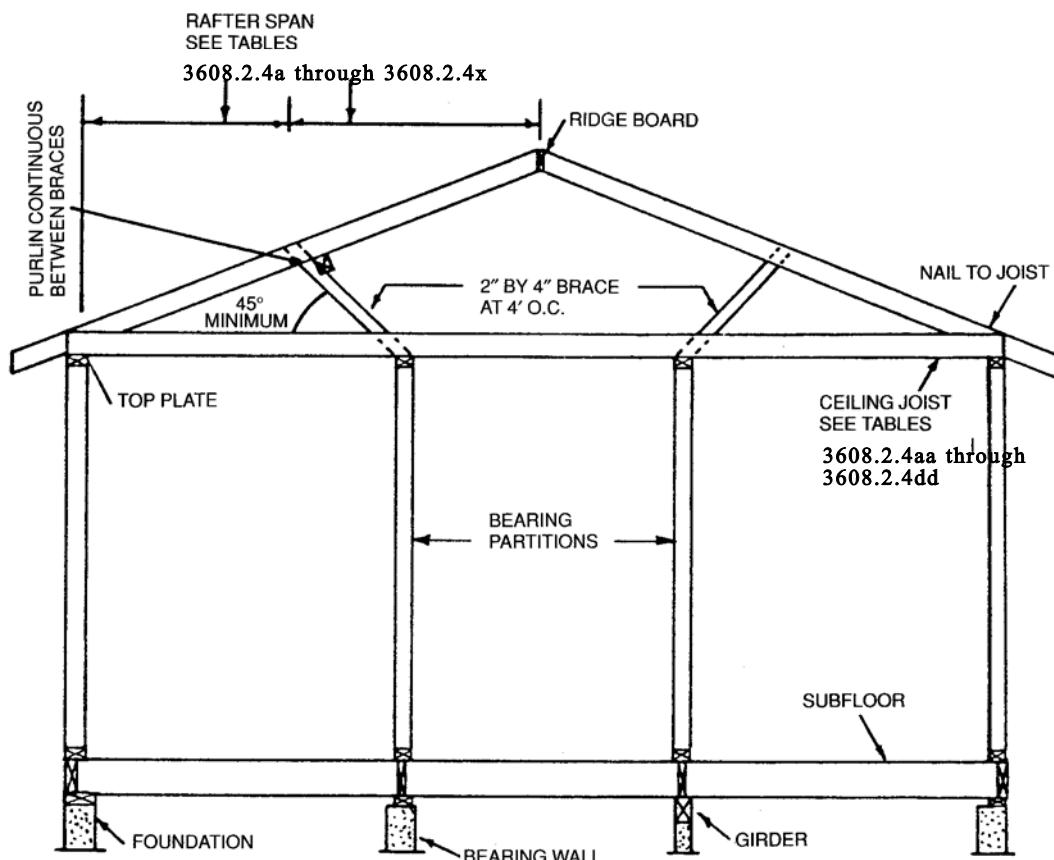
**3608.2.4 Allowable spans:** The unsupported spans for ceiling joists shall not exceed the values set forth in Tables **3608.2.4aa** through **3608.2.4dd**. The unsupported spans for rafters shall not exceed the values set forth in Tables **3608.2.4a through 3608.2.4x**. When the roof pitch is less than three

units vertical in 12 units horizontal (25% slope), members supporting rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams. Selection of rafters shall be based on lumber properties, snow load zone and deflection due to live load based on ceiling finish (see table 3603.1.6

**3608.2.4.1 Purlins:** Purlins may be installed to reduce the span of rafters as shown in Figure **3608.2.4.1**. Purlins shall be sized no less than the required size of the rafters that they support. Purlins shall be continuous and shall be supported by two by four (51 by 102) struts installed to bearing walls at a slope not less than 45 degrees from the horizontal. The struts shall be spaced not more than four feet (1219 mm) on center, and the unbraced length of struts shall not exceed eight feet (2438 mm).



**FIGURE 3608.2.4.1  
BRACED RAFTER CONSTRUCTION**



For SI: one inch = 25.4 mm, one foot = 304.8 mm.

NOTE: Where ceiling joists run perpendicular to the rafters, rafter ties shall be nailed to the rafters near the plate line and spaced not more than four feet on center.

**3608.2.5 Bearing:** The ends of each rafter or ceiling joist shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry.

**3608.2.6 Cutting and notching:** It shall be unlawful to notch, cut or pierce wood beams, joists or rafters in excess of the limitations herein specified, unless proven safe by structural analysis or suitably reinforced to transmit all calculated *loads*. Notches in the top or bottom of rafter shall not exceed  $\frac{1}{16}$  of the depth of the rafter, ***shall not be longer than the depth of the member*** and shall not be located in the middle third of the span. ***Notch depth at the ends of the member*** shall not exceed  $\frac{1}{4}$  the rafter depth.

**3608.2.7 Holes:** Holes drilled, bored ***or cut*** into rafters shall ***not be closer than*** two inches (51 mm) to the top or bottom of the rafters, ***or to any other hole located in the rafter. Where the rafter is notched, the hole shall not be closer than two***

**Exceptions:**

1. ***A notch over the support is permitted to extend the full width of the support.***
2. ***Notches on cantilevered portions of the member are permitted to extend the full length of the cantilever if the strength and deflection of the cantilever is calculated based on the reduced member section.***
3. ***The tension side of rafters which are four inches or greater in nominal thickness, shall not be notched, except at ends of members.***

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**inches to the notch.** The diameter *of the hole* shall not exceed \_ the depth of the rafter.

**3608.2.8 Lateral support:** Rafters and ceiling joists having a depth-to-thickness ratio exceeding five to one based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation.

**3608.2.8.1 Bridging:** Rafters and ceiling joists having a depth-to-thickness ratio exceeding six to one based on nominal dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or a continuous one-inch-by-three-inch (25 mm by 76 mm) wood strip nailed across the rafters or ceiling joists at intervals not exceeding ten feet (3048 mm).

**3608.2.9 Framing of openings:** Openings in roof and ceiling framing shall be framed with headers between ceiling joists or rafters. When the header span does not exceed four feet (1219 mm), the header may be a single member the same size as the ceiling joist or rafter. When the header span exceeds four feet (1219 mm), the header and the joists or rafters that support the header shall be doubled, and approved hangers shall be used to connect the header to the joists or rafters.

**3608.2.10 Trusses:** Wood trusses shall be designed in accordance with approved engineering practice. Truss components may be joined by nails, glue, timber connectors or other approved fastening devices. The design of metal plate connected wood trusses shall comply with TPI QST, TPI PCT and TPI-1985 "Design Specification for Metal Plate Connected Wood Trusses", *each as listed in Appendix A*. Trusses shall be braced according to their appropriate engineered design. In the absence of specific bracing requirements, trusses shall be braced in accordance with TPI BWT, *as listed in Appendix A*. Truss members shall not be cut or altered unless so designed.

**3608.2.11 Roof tie-down:** Roof assemblies subject to wind uplift pressures of 20 pounds per square foot ( $0.958 \text{ kN/m}^2$ ) or greater, shall have rafter or truss ties provided in accordance with Table 3608.2.12. The resulting uplift forces from the rafter or truss ties shall be transmitted to the foundation.

Table 3608.3.1. Spaced lumber sheathing for wood shingle and shake roofing shall conform to the requirements of 780 CMR 3609.8 and 3609.9.

**3608.3.2 Plywood sheathing:**

**3608.3.2.1 Identification and grade:** Plywood and wood structural panels shall conform to DOC PS 1 or DOC PS 2 *as listed in Appendix A*, and shall be identified by grade mark or certificate of inspection issued by an approved agency. Plywood and wood structural panels shall comply with the grades specified in Table 3605.3.2.1.1a.

**3608.3.2.1.1 Type:** All plywood, when designed to be exposed in outdoor applications, shall be of an exterior type. Plywood or wood structural panel roof sheathing exposed to the underside may be of interior type bonded with exterior glue, identified as Exposure 1.

**3608.3.2.1.2 Fire-retardant-treated plywood:** The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an approved method of investigation which considers the effects of anticipated temperature and humidity to which the fire-retardant plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an approved agency.

**3608.3.2.1.3 Wood structural panels:** Wood structural-use panels conforming to DOC PS 2, *as listed in Appendix A*, includes performance-rated plywood, oriented strandboard and composite panels. Oriented strandboard structural-use panels manufactured in Canada shall conform to CSA 0437 *as listed in Appendix A*.

**3608.3.2.2 Allowable spans:** The maximum allowable spans for plywood and wood structural panel roof sheathing shall not exceed the values set forth in Table 3605.3.2.1.1a.

**3608.3.2.3 Installation:** Plywood and wood structural panel roof sheathing shall be installed with joints staggered or nonstaggered in accordance with Tables 3605.3.2.1.1a and 3606.2.3a, or APA E 30 *as listed in Appendix A*.

## 780 CMR 3608.3 ROOF SHEATHING

**3608.3.1 Lumber sheathing:** Allowable spans for lumber used as roof sheathing shall conform to

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**TABLE 3608.2.12**  
**WIND UPLIFT FORCES ON ROOF**  
**TRUSSES AND RAFTERS<sup>1, 2, 3, 4</sup>**  
**(Pounds Per Tie-Down Connection)**

WIND UPLIFT PRESSURE ON ROOF (psf) <sup>5</sup>	TOTAL BUILDING WIDTH ROOF INCLUDING OVERHANG (feet)				
	24	28	32	36	40
20	192	224	256	288	320
30	432	504	576	648	720
40	672	784	895	1,008	1,120
50	912	1,064	1,216	1,368	1,520
60	1,152	1,344	1,536	1,728	1,920
70	1,392	1,624	1,856	2,088	2,320
80	1,632	1,904	2,176	2,448	2,720
90	1,872	2,184	2,496	2,808	3,120

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, psf = 0.0479 kNm<sup>2</sup>

1. A continuous load path capable of resisting the tributary forces shall be provided from tie-down connections to the foundation.
2. Wind uplift forces are based on 24-inch spacing of roof trusses or rafters. For spacing other than 24 inches, forces shall be adjusted accordingly.
3. Interpolation is permitted for intermediate values of wind uplift pressures and building widths.
4. The rated capacity of approved tie-down devices is permitted to include a \_ increase for wind effects.
5. Tie-down connections shall be provided at bearing walls for roof trusses or rafters to resist wind uplift forces.

### 3608.3.3 Particleboard sheathing:

#### 3608.3.3.1 Identification and grade:

Particleboard roof sheathing shall conform to Type 2-M-W as set forth in ANSI A208.1 *as listed in Appendix A* and shall be so identified by a grade mark or certificate of inspection issued by an approved agency.

**3608.3.3.2 Allowable spans:** The allowable loads and spans for particleboard roof sheathing shall not exceed the values set forth in Table 3608.3.3.2.

**3608.3.3.3 Installation:** Particleboard roof sheathing shall be installed in accordance with Tables 3606.2.3a and 3608.3.3.2. Where walls are subject to wind pressures of 30 pounds per square foot (1.44 kN/m<sup>2</sup>) or greater, particleboard roof sheathing shall be attached to the gable end with 8d common nails spaced at no more than four inches **on center** (102 mm), or equivalent fasteners.

48 <sup>1</sup>	1½ T & G
60 <sup>2</sup>	
72 <sup>3</sup>	

For SI: 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

1. Minimum 270  $F_b$ , 340,000 E.
2. Minimum 420  $F_b$ , 660,000 E.
3. Minimum 600  $F_b$ , 1,150,000 E.

**TABLE 3803.3.2**  
**ALLOWABLE LOADS FOR**  
**PARTICLEBOARD ROOF SHEATHING<sup>1, 2, 3</sup>**

GRADE	TH
2-M-W	

For SI: 1 inch = 25.4 mm, 1 psi = 6895 kPa.

1. Panels are continuous over two or more spans.
2. Uniform load deflection limitations:  $\frac{1}{180}$  of the span under live load plus dead load and  $\frac{1}{240}$  of the span under live load only.
3. The panels may be applied parallel or perpendicular to the span of the rafters or joists and shall be continuous over two or more spans. If the panels are applied perpendicular to roof supports, the end joints of the panels shall be offset so that four panel corners will not meet. Cutouts for items such as plumbing and electrical shall be oversized to avoid a forced fit. A  $\frac{1}{2}$ -inch gap must be provided between the panel and concrete masonry walls. Leave a  $\frac{1}{16}$ -inch gap between panels and nail no closer than \_ inch from panel edge.
4. Edges shall be tongue and groove or supported with blocking or edge clips.

## 780 CMR 3608.4 METAL

**3608.4.1 General:** Elements shall be straight and free of any defects which would significantly affect their structural performance.

**TABLE 3608.3.1**  
**MINIMUM THICKNESS LUMBER ROOF**  
**SHEATHING**

RAFTER OR BEAM SPACING (inches)	MINIMUM NET THICKNESS (inches)
24	_

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**3608.4.2 Steel Elements:** *Steel structural elements in roof-ceiling construction may be either hot-rolled structural steel shapes or members cold formed to shape from steel strip or plate or a fabricated combination thereof. Steel structural members in roof-ceiling construction shall be designed in accordance with the AISC "Specification for the Design", "Fabrication and Erection of Structural Steel for Buildings" as listed in Appendix A.*

**3608.4.3 Aluminum Elements:** *Aluminum structural elements in roof-ceiling systems shall, be constructed of materials and designed in accordance with AA SAS 30 as listed in Appendix A.*

## 780 CMR 3608.5 CEILING FINISHES

**3608.5.1 Ceiling installation:** Ceilings shall be installed in accordance with the requirements for interior wall finishes, as provided in **780 CMR 3607.2**.

## 780 CMR 3608.6 ROOF VENTILATION

**3608.6.1 Ventilation required:** Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with the least dimension being \_ inch (3.2 mm).

**3608.6.2 Minimum area:** The total net free ventilating area shall not be less than one to 150 of the area of the space ventilated except that the total area is permitted to be reduced to one to 300, provided at least 50% and not more than 80% of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least three feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to one to 300 when a vapor barrier having a transmission rate not exceeding one perm (57.4 ng/s·m<sup>2</sup>·Pa) is installed on the warm side of the ceiling.

**3608.6.3 Vent clearance:** Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of one-inch (25 mm) space shall be provided between the insulation and the roof sheathing at the location of the vent.

## 780 CMR 3608.7 ATTIC ACCESS

**3608.7.1 Accessible attic access:** A readily accessible attic access framed opening not less than 22 inches by 30 inches (559 mm by 762 mm) shall be provided to any attic area having a clear height of over 30 inches (762 mm).

**TABLE 3608.2.4aa**  
**ALLOWABLE SPANS FOR CEILING JOISTS**  
**20 Lbs. per Sq. Ft. Live Load**  
**(Limited attic storage where development of future rooms is not possible)**  
**(Veneer Plaster Ceiling)**

**DESIGN CRITERIA:** Deflection—For 20 lbs. per sq. ft. live load. Limited to span in inches divided by 360. Strength—Live load of 20 lbs. per sq. ft. plus dead load of 10 lbs. per sq. ft. determines fiber stress value shown.

**HOW TO USE TABLES:** Enter table with span of joists (upper figure in each square). Determine size and spacing (first column) based stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

JOIST SIZE AND SPACING		MODULUS OF ELASTICITY, "E," IN 1,000,000 PSi									
(inches)	(inches)	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2 x 4	24.0	5-5	5-10	6-2	6-6	6-10	7-1	7-4	7-7	7-10	8-0
		12.0	430	500	560	630	680	740	790	850	900
		4-11	5-4	5-8	5-11	6-2	6-5	6-0	6-11	7-1	7-3
		16.0	470	550	620	690	750	810	870	930	990
		4-4	4-8	4-11	5-2	5-5	5-8	5-10	6-0	6-2	6-4
	24.0	540	630	710	790	860	930	1,000	1,070	1,130	1,190
		8-6	9-2	9-9	10-3	10-9	11-2	11-7	11-11	12-3	12-7
		12.0	430	500	560	630	680	740	790	850	900
		7-9	8-4	8-10	9-4	9-9	10-2	10-6	10-10	11-2	11-5
		16.0	470	550	620	690	750	810	870	930	990
2 x 6	24.0	6-9	7-3	7-9	8-2	8-6	8-10	9-2	9-6	9-9	10-0
		540	630	710	790	860	930	1,000	1,070	1,130	1,190
		11-3	12-1	12-10	13-6	14-2	14-8	15-3	15-9	16-2	16-7
		12.0	430	500	560	630	680	740	790	850	900
		10-2	11-0	11-8	12-3	12-10	13-4	13-10	14-3	14-8	15-1
	24.0	470	550	620	690	750	810	870	930	990	1,040
		16.0	470	550	620	690	750	810	870	930	990
		8-11	9-7	10-2	10-9	11-3	11-8	12-1	12-6	12-10	13-2
		540	630	710	790	860	930	1,000	1,070	1,130	1,190
		14-4	15-5	16-5	17-3	18-0	18-9	19-5	20-1	20-8	21-2
2 x 8	24.0	12.0	430	500	560	630	680	740	790	850	900
		13-0	14-0	14-11	15-8	16-5	17-0	17-8	18-3	18-9	19-3
		16.0	470	550	620	690	750	810	870	930	990
		11-4	12-3	13-0	13-8	14-4	14-11	15-5	15-11	16-5	16-10
		540	630	710	790	860	930	1,000	1,070	1,130	1,190
	24.0	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	
		8-3	8-5	8-7	8-9	8-11	9-1	9-3	9-7	9-10	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	1,420
		7-6	7-8	7-10	8-0	8-1	8-3	8-5	8-8	8-11	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
2 x 10	24.0	6-6	6-8	6-10	7-0	7-1	7-3	7-4	7-7	7-10	
		1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790	
		12-11	13-3	13-6	13-9	14-1	14-4	14-7	15-0	15-6	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	1,420
		11-9	12-0	12-3	12-6	12-9	13-0	13-3	13-8	14-1	
	24.0	16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
		10-3	10-6	10-9	10-11	11-2	11-4	11-7	11-11	12-3	
		1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790	
		17-0	17-5	17-10	18-2	18-6	18-10	19-2	19-10	20-5	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	1,420
2 x 6	24.0	15-6	15-10	16-2	16-6	16-10	17-2	17-5	18-0	18-6	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
		13-6	13-10	14-2	14-5	14-8	15-0	15-3	15-9	16-2	
		24.0	1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790
		21-9	22-3	22-9	23-2	23-8	24-1	24-6	25-3	26-0	
	24.0	12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	1,420
		19-9	20-2	20-8	21-1	21-6	21-10	22-3	22-11	23-8	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
		17-3	17-8	18-0	18-5	18-9	19-1	19-5	20-1	20-8	
		24.0	1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790
2 x 8	24.0	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	
		8-3	8-5	8-7	8-9	8-11	9-1	9-3	9-7	9-10	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	
		7-6	7-8	7-10	8-0	8-1	8-3	8-5	8-8	8-11	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
	24.0	6-6	6-8	6-10	7-0	7-1	7-3	7-4	7-7	7-10	
		1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790	
		12-11	13-3	13-6	13-9	14-1	14-4	14-7	15-0	15-6	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	
		11-9	12-0	12-3	12-6	12-9	13-0	13-3	13-8	14-1	
2 x 10	24.0	16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
		10-3	10-6	10-9	10-11	11-2	11-4	11-7	11-11	12-3	
		1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790	
		17-0	17-5	17-10	18-2	18-6	18-10	19-2	19-10	20-5	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	
	24.0	15-6	15-10	16-2	16-6	16-10	17-2	17-5	18-0	18-6	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
		13-6	13-10	14-2	14-5	14-8	15-0	15-3	15-9	16-2	
		24.0	1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790
		21-9	22-3	22-9	23-2	23-8	24-1	24-6	25-3	26-0	
2 x 6	24.0	12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	1,420
		19-9	20-2	20-8	21-1	21-6	21-10	22-3	22-11	23-8	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
		17-3	17-8	18-0	18-5	18-9	19-1	19-5	20-1	20-8	
		24.0	1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,790
	24.0	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	
		8-3	8-5	8-7	8-9	8-11	9-1	9-3	9-7	9-10	
		12.0	990	1,040	1,090	1,130	1,170	1,220	1,260	1,340	
		7-6	7-8	7-10	8-0	8-1	8-3	8-5	8-8	8-11	
		16.0	1,090	1,140	1,200	1,240	1,290	1,340	1,390	1,480	1,570
2 x 8	24.0	6-6	6-8	6-10	7-0	7-1	7-3	7-4	7-7	7-10	
		1,250	1,310	1,370	1,420	1,480	1,530	1,590	1,690	1,79	

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NOTE: The extreme fiber stress in bending, " $F_b$ ," in pounds per square inch is shown below each span.

## THE MASSACHUSETTS STATE BUILDING CODE

**TABLE 3608.2.4bb**  
**ALLOWABLE SPANS FOR CEILING JOISTS**  
**20 Lbs. per Sq. Ft. Live Load**

**(Limited attic storage where development of future rooms is not possible)**  
**(Gypsum Ceiling)**

**DESIGN CRITERIA:** Deflection—For 20 lbs. per sq. ft. live load. Limited to span in inches divided by 240.

Strength—Live load of 20 lbs. per sq. ft. plus dead load of 10 lbs. per sq. ft. determines fiber stress value.

**HOW TO USE TABLES:** Enter table with span of joists (upper figure in each square). Determine size and spacing (first column) based stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

JOIST SIZE AND SPACING		MODULUS OF ELASTICITY, "E," IN 1,000,000 PSI									
(inches)	(inches)	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2 x 4	12.0	6-2 560	6-8 660	7-1 740	7-6 820	7-10 900	8-1 970	8-5 1,040	8-8 1,110	8-11 1,170	9-2 1,240
		5-8 620	6-1 720	6-5 810	6-9 900	7-1 990	7-5 1,070	7-8 1,140	7-11 1,220	8-1 1,290	8-4 1,360
	16.0	4-11 710	5-4 830	5-8 930	5-11 1,030	6-2 1,130	6-5 1,220	6-8 1,310	6-11 1,400	7-1 1,480	7-3 1,560
		7-9 710	8-4 830	8-10 930	9-4 1,030	9-9 1,130	10-2 1,220	10-6 1,310	10-10 1,400	11-2 1,480	11-5 1,560
	24.0	9-9 560	10-6 660	11-2 740	11-9 820	12-3 900	12-9 970	13-3 1,040	13-8 1,110	14-1 1,170	14-5 1,240
		8-10 620	9-6 720	10-2 810	10-8 900	11-2 990	11-7 1,070	12-0 1,140	12-5 1,220	12-9 1,290	13-1 1,360
2 x 6	12.0	7-9 710	8-4 830	8-10 930	9-4 1,030	9-9 1,130	10-2 1,220	10-6 1,310	10-10 1,400	11-2 1,480	11-5 1,560
		12-10 560	13-10 660	14-8 740	15-6 820	16-2 900	16-10 970	17-5 1,040	18-0 1,110	18-6 1,170	19-0 1,240
	16.0	11-8 620	12-7 720	13-4 810	14-1 900	14-8 990	15-3 1,070	15-10 1,140	164 1,220	16-10 1,290	17-3 1,360
		10-2 710	11-0 830	11-8 930	12-3 1,030	12-10 1,130	13-4 1,220	13-10 1,310	14-3 1,400	14-8 1,480	15-1 1,560
	24.0	16-5 560	17-8 660	18-9 740	19-9 820	20-8 900	21-6 970	22-3 1,040	22-11 1,110	23-8 1,170	24-3 1,240
		14-11 620	16-0 720	17-0 810	17-11 900	18-9 990	19-6 1,070	20-2 1,140	20-10 1,220	21-6 1,290	22-1 1,360
2 x 8	12.0	13-0 710	14-0 830	14-11 930	15-8 1,030	16-5 1,130	17-0 1,220	17-8 1,310	18-3 1,400	18-9 1,480	19-3 1,560
		16.0	17-8 660	18-9 740	19-9 820	20-8 900	21-6 970	22-3 1,040	22-11 1,110	23-8 1,170	24-3 1,240
	16.0	14-11 620	16-0 720	17-0 810	17-11 900	18-9 990	19-6 1,070	20-2 1,140	20-10 1,220	21-6 1,290	22-1 1,360
		24.0	13-0 710	14-0 830	14-11 930	15-8 1,030	16-5 1,130	17-0 1,220	17-8 1,310	18-3 1,400	18-9 1,480
	24.0	16-5 560	17-8 660	18-9 740	19-9 820	20-8 900	21-6 970	22-3 1,040	22-11 1,110	23-8 1,170	24-3 1,240
		14-11 620	16-0 720	17-0 810	17-11 900	18-9 990	19-6 1,070	20-2 1,140	20-10 1,220	21-6 1,290	22-1 1,360
2 x 10	12.0	13-0 710	14-0 830	14-11 930	15-8 1,030	16-5 1,130	17-0 1,220	17-8 1,310	18-3 1,400	18-9 1,480	19-3 1,560
		16.0	17-8 660	18-9 740	19-9 820	20-8 900	21-6 970	22-3 1,040	22-11 1,110	23-8 1,170	24-3 1,240
	16.0	14-11 620	16-0 720	17-0 810	17-11 900	18-9 990	19-6 1,070	20-2 1,140	20-10 1,220	21-6 1,290	22-1 1,360
		24.0	13-0 710	14-0 830	14-11 930	15-8 1,030	16-5 1,130	17-0 1,220	17-8 1,310	18-3 1,400	18-9 1,480
	24.0	16-5 560	17-8 660	18-9 740	19-9 820	20-8 900	21-6 970	22-3 1,040	22-11 1,110	23-8 1,170	24-3 1,240
		14-11 620	16-0 720	17-0 810	17-11 900	18-9 990	19-6 1,070	20-2 1,140	20-10 1,220	21-6 1,290	22-1 1,360
2 x 4	12.0	9-5 1,300	9-8 1,360	9-10 1,420	10-0 1,480	10-3 1,540	10-5 1,600	10-7 1,650	10-11 1,760	11-3 1,860	
		8-7 1,430	8-9 1,500	8-11 1,570	9-1 1,630	9-4 1,690	9-6 1,760	9-8 1,820	9-11 1,940	10-3 2,050	
	16.0	7-6 1,640	7-8 1,720	7-10 1,790	8-0 1,870	8-1 1,940	8-3 2,010	8-5 2,080	8-8 2,220	8-11 2,350	
		12.0	14-9 1,300	15-2 1,360	15-6 1,420	15-9 1,480	16-1 1,540	16-4 1,600	16-8 1,650	17-2 1,760	17-8 1,860
	24.0	13-5 1,640	13-9 1,720	14-1 1,790	14-4 1,870	14-7 1,940	14-11 2,010	15-2 2,080	15-7 2,220	16-1 2,350	
		16.0	11-9 1,640	12-0 1,720	12-3 1,790	12-6 1,870	12-9 1,940	13-0 2,010	13-3 2,080	13-8 2,220	14-1 2,350
2 x 6	12.0	19-6 1,300	19-11 1,360	20-5 1,420	20-10 1,480	21-2 1,540	21-7 1,600	21-11 1,650	22-8 1,760	23-4 1,860	
		16.0	17-9 1,430	18-2 1,500	18-6 1,570	18-11 1,630	19-3 1,690	19-7 1,760	19-11 1,820	20-7 1,940	21-2 2,050
	24.0	15-6 1,640	15-10 1,720	16-2 1,790	16-6 1,870	16-10 1,940	17-2 2,010	17-5 2,080	18-0 2,220	18-6 2,350	
		12.0	24-10 1,300	25-5 1,360	26-0 1,420	26-6 1,480	27-1 1,540	27-6 1,600	28-0 1,650	28-11 1,760	29-9 1,860
	16.0	22-7 1,430	23-2 1,500	23-8 1,570	24-1 1,630	24-7 1,690	25-0 1,760	25-5 1,820	26-3 1,940	27-1 2,050	
		24.0	19-9 1,640	20-2 1,720	20-8 1,790	21-1 1,870	21-6 1,940	21-10 2,010	22-3 2,080	22-11 2,220	23-8 2,350
2 x 8	12.0	24-10 1,300	25-5 1,360	26-0 1,420	26-6 1,480	27-1 1,540	27-6 1,600	28-0 1,650	28-11 1,760	29-9 1,860	
		16.0	22-7 1,430	23-2 1,500	23-8 1,570	24-1 1,630	24-7 1,690	25-0 1,760	25-5 1,820	26-3 1,940	27-1 2,050
	24.0	19-9 1,640	20-2 1,720	20-8 1,790	21-1 1,870	21-6 1,940	21-10 2,010	22-3 2,080	22-11 2,220	23-8 2,350	
		12.0	14-9 1,300	15-2 1,360	15-6 1,420	15-9 1,480	16-1 1,540	16-4 1,600	16-8 1,650	17-2 1,760	17-8 1,860
	16.0	13-5 1,430	13-9 1,500	14-1 1,570	14-4 1,630	14-7 1,690	14-11 1,760	15-2 1,820	15-7 1,940	16-1 2,050	
		24.0	11-9 1,640	12-0 1,720	12-3 1,790	12-6 1,870	12-9 1,940	13-0 2,010	13-3 2,080	13-8 2,220	14-1 2,350
2 x 10	12.0	24-10 1,300	25-5 1,360	26-0 1,420	26-6 1,480	27-1 1,540	27-6 1,600	28-0 1,650	28-11 1,760	29-9 1,860	
		16.0	22-7 1,430	23-2 1,500	23-8 1,570	24-1 1,630	24-7 1,690	25-0 1,760	25-5 1,820	26-3 1,940	27-1 2,050
	24.0	19-9 1,640	20-2 1,720	20-8 1,790	21-1 1,870	21-6 1,940	21-10 2,010	22-3 2,080	22-11 2,220	23-8 2,350	
		12.0	14-9 1,300	15-2 1,360	15-6 1,420	15-9 1,480	16-1 1,540	16-4 1,600	16-8 1,650	17-2 1,760	17-8 1,860
	16.0	13-5 1,430	13-9 1,500	14-1 1,570	14-4 1,630	14-7 1,690	14-11 1,760	15-2 1,820	15-7 1,940	16-1 2,050	
		24.0	11-9 1,640	12-0 1,720	12-3 1,790	12-6 1,870	12-9 1,940	13-0 2,010	13-3 2,080	13-8 2,220	14-1 2,350

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

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NOTE: The extreme fiber stress in bending, " $F_b$ ," in pounds per square inch is shown below each span.

## THE MASSACHUSETTS STATE BUILDING CODE

**TABLE 3608.2.4cc**  
**ALLOWABLE SPANS FOR CEILING JOISTS**  
**10 Lbs. per Sq. Ft. Live Load**  
**(No attic storage and roof slope not steeper than 3 in 1 2)**  
**(Veneer Plaster Ceiling)**

**DESIGN CRITERIA:** Deflection-For 10 lbs. per sq. Ft. live load. Limited to span in inches divided by 360. Strength-Live load of 10 lbs. per sq. Ft. plus dead load of 5 lbs. per sq. ft. determines fiber stress value.

**HOW TO USE TABLES:** Enter table with span of joists (upper figure in each square). Determine size and spacing (first column) based stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

<b>JOIST SIZE AND SPACING</b>		<b>MODULUS OF ELASTICITY, "E" IN 1,000,000 PSI</b>									
<b>(inches)</b>	<b>(inches)</b>	<b>0.4</b>	<b>0.5</b>	<b>0.6</b>	<b>0.7</b>	<b>0.8</b>	<b>0.9</b>	<b>1.0</b>	<b>1.1</b>	<b>1.2</b>	<b>1.3</b>
2 x 4	12.0	6-10 340	7-4 400	7-10 450	8-3 500	8-7 540	8-11 590	9-3 630	9-7 670	9-10 710	10-1 750
		6-2 380	6-8 440	7-1 490	7-6 550	7-10 600	8-1 650	8-5 690	8-8 740	8-11 780	9-2 830
		5-5 430	5-10 500	6-2 560	6-6 630	6-10 680	7-1 740	7-4 790	7-7 850	7-10 900	8-0 950
	16.0	10-9 340	11-7 400	12-3 450	12-11 500	13-6 540	14-1 590	14-7 630	15-0 670	15-6 710	15-11 750
		9-9 380	10-6 440	11-2 490	11-9 550	12-3 600	12-9 650	13-3 690	13-8 740	14-1 780	14-5 830
		8-6 430	9-2 500	9-9 560	10-3 630	10-9 680	11-2 740	11-7 790	11-11 850	12-3 900	12-7 950
	24.0	14-2 340	15-3 400	16-2 450	17-0 500	17-10 540	18-6 590	19-2 630	19-10 670	20-5 710	20-11 750
		12-10 380	13-10 440	14-8 490	15-6 550	16-2 600	16-10 650	17-5 690	18-0 740	18-6 780	19-0 830
		11-3 430	12-1 500	12-10 560	13-6 630	14-2 680	14-8 740	15-3 790	15-9 850	16-2 900	16-7 950
2 x 6	12.0	18-0 340	19-5 400	20-8 450	21-9 500	22-9 540	23-8 590	24-6 630	25-3 670	26-0 710	26-9 750
		16-5 380	17-8 440	18-9 490	19-9 550	20-8 600	21-6 650	22-3 690	22-11 740	23-8 780	24-3 830
		14-4 430	15-5 500	16-5 560	17-3 630	18-0 680	18-9 740	19-5 790	20-1 850	20-8 900	21-2 950
	16.0	21-4 340	22-5 400	23-6 450	24-7 500	25-8 540	26-9 590	27-6 630	28-3 670	29-0 710	29-9 750
		19-6 380	20-7 440	21-8 490	22-9 550	23-10 600	24-11 650	25-12 690	26-13 740	27-14 780	28-15 830
		17-0 430	18-1 500	19-2 560	20-3 630	21-4 680	22-5 740	23-6 790	24-7 850	25-8 900	26-9 950
	24.0	24-4 340	25-5 400	26-6 450	27-7 500	28-8 540	29-9 590	30-10 630	31-11 670	32-12 710	33-13 750
		22-4 380	23-5 440	24-6 490	25-7 550	26-8 600	27-9 650	28-10 690	29-11 740	30-12 780	31-13 830
		20-4 430	21-5 500	22-6 560	23-7 630	24-8 680	25-9 740	26-10 790	27-11 850	28-12 900	29-13 950
2 x 8	12.0	26-4 340	27-5 400	28-6 450	29-7 500	30-8 540	31-9 590	32-10 630	33-11 670	34-12 710	35-13 750
		24-4 380	25-5 440	26-6 490	27-7 550	28-8 600	29-9 650	30-10 690	31-11 740	32-12 780	33-13 830
		22-4 430	23-5 500	24-6 560	25-7 630	26-8 680	27-9 740	28-10 790	29-11 850	30-12 900	31-13 950
	16.0	30-4 340	31-5 400	32-6 450	33-7 500	34-8 540	35-9 590	36-10 630	37-11 670	38-12 710	39-13 750
		28-4 380	29-5 440	30-6 490	31-7 550	32-8 600	33-9 650	34-10 690	35-11 740	36-12 780	37-13 830
		26-4 430	27-5 500	28-6 560	29-7 630	30-8 680	31-9 740	32-10 790	33-11 850	34-12 900	35-13 950
	24.0	34-4 340	35-5 400	36-6 450	37-7 500	38-8 540	39-9 590	40-10 630	41-11 670	42-12 710	43-13 750
		32-4 380	33-5 440	34-6 490	35-7 550	36-8 600	37-9 650	38-10 690	39-11 740	40-12 780	41-13 830
		30-4 430	31-5 500	32-6 560	33-7 630	34-8 680	35-9 740	36-10 790	37-11 850	38-12 900	39-13 950
2 x 10	12.0	38-4 340	39-5 400	40-6 450	41-7 500	42-8 540	43-9 590	44-10 630	45-11 670	46-12 710	47-13 750
		36-4 380	37-5 440	38-6 490	39-7 550	40-8 600	41-9 650	42-10 690	43-11 740	44-12 780	45-13 830
		34-4 430	35-5 500	36-6 560	37-7 630	38-8 680	39-9 740	40-10 790	41-11 850	42-12 900	43-13 950
	16.0	46-4 340	47-5 400	48-6 450	49-7 500	50-8 540	51-9 590	52-10 630	53-11 670	54-12 710	55-13 750
		44-4 380	45-5 440	46-6 490	47-7 550	48-8 600	49-9 650	50-10 690	51-11 740	52-12 780	53-13 830
		42-4 430	43-5 500	44-6 560	45-7 630	46-8 680	47-9 740	48-10 790	49-11 850	50-12 900	51-13 950
	24.0	52-4 340	53-5 400	54-6 450	55-7 500	56-8 540	57-9 590	58-10 630	59-11 670	60-12 710	61-13 750
		50-4 380	51-5 440	52-6 490	53-7 550	54-8 600	55-9 650	56-10 690	57-11 740	58-12 780	59-13 830
		48-4 430	49-5 500	50-6 560	51-7 630	52-8 680	53-9 740	54-10 790	55-11 850	56-12 900	57-13 950

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

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NOTE: The extreme fiber stress in bending, " $F_b$ ," in pounds per square inch is shown below each span.

## THE MASSACHUSETTS STATE BUILDING CODE

**TABLE 3608.2.4dd**  
**ALLOWABLE SPANS FOR CEILING JOISTS**  
**10 Lbs per Sq. Ft. Live Load**  
**(No attic storage and roof slope not steeper than 3 in 12)**  
**(Gypsum Ceiling)**

**DESIGN CRITERIA:** Deflection—For 10 lbs. per sq. ft. live load. Limited to span in inches divided by 240. Strength—Live load of 10 lbs. per sq. ft. plus dead load of 5 lbs. per sq. ft. determines fiber stress value.

**HOW TO USE TABLES:** Enter table with span of joists (upper figure in each square). Determine size and spacing (first column) based stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

<b>JOIST SIZE AND SPACING</b>		<b>MODULUS OF ELASTICITY, "E," IN 1,000,000 PSI</b>									
<b>(inches)</b>	<b>(inches)</b>	<b>0.4</b>	<b>0.5</b>	<b>0.6</b>	<b>0.7</b>	<b>0.8</b>	<b>0.9</b>	<b>1.0</b>	<b>1.1</b>	<b>1.2</b>	<b>1.3</b>
2 x 4	12.0	7-10 450	8-5 520	8-11 590	9-5 650	9-10 710	10-3 770	10-7 830	10-11 880	11-3 930	11-7 980
		16.0	7-1 490	7-8 570	8-1 650	8-7 720	8-11 780	9-4 850	9-8 910	9-11 970	10-3 1,030
	24.0	6-2 560	6-8 660	7-1 740	7-6 820	7-10 900	8-1 970	8-5 I,040	8-8 1,110	8-11 1,170	9-2 1,240
		12.0	12-3 450	13-3 520	14-1 590	14-9 650	15-6 710	16-1 770	16-8 830	17-2 880	17-8 930
	16.0	16.0	11-2 490	12-0 570	12-9 650	13-5 720	14-1 780	14-7 850	15-2 910	15-7 970	16-1 1,030
		24.0	9-9 560	10-6 660	11-2 740	11-9 820	12-3 900	12-9 970	13-3 I,040	13-8 1,110	14-1 1,170
	2 x 6	12.0	16-2 450	17-5 520	18-6 590	19-6 650	20-5 710	21-2 770	21-11 830	22-8 880	23-4 930
		16.0	14-8 490	15-10 570	16-10 650	17-9 720	18-6 780	19-3 850	19-11 910	20-7 970	21-2 1,030
		24.0	12-10 560	13-10 660	14-8 740	15-6 820	16-2 900	16-10 970	17-5 I,040	18-0 1,110	18-6 1,170
	2x8	12.0	20-8 450	22-3 520	23-8 590	24-10 650	26-0 710	27-1 770	28-0 830	28-11 880	29-9 930
		16.0	18-9 490	20-2 570	21-6 650	22-7 720	23-8 780	24-7 850	25-5 910	26-3 970	27-1 1,030
		24.0	16-5 560	17-8 660	18-9 740	19-9 820	20-8 900	21-6 970	22-3 I,040	22-11 1,110	23-8 1,170
		12.0	11-10 1,030	12-2 1,080	12-5 1,130	12-8 1,180	12-11 1,220	13-2 1,270	13-4 1,310	13-9 I,400	14-2 1,480
		16.0	10-9 1,140	11-0 1,190	11-3 1,240	11-6 1,290	11-9 1,340	11-11 1,390	12-2 1,440	12-6 1,540	12-11 1,630
		24.0	9-5 I,300	9-8 1,360	9-10 1,420	10-0 1,480	10-3 1,540	10-5 1,600	10-7 1,650	10-11 1,760	11-3 1,860
		12.0	18-8 1,030	19-1 1,080	19-6 1,130	19-11 1,180	20-3 1,220	20-8 1,270	21-0 1,310	21-8 1,400	22-4 1,480
		16.0	16-11 1,140	17-4 1,190	17-8 1,240	18-1 1,290	18-5 1,340	18-9 1,390	19-1 1,440	19-8 1,540	20-3 1,630
		24.0	14-9 1,300	15-2 1,360	15-6 1,420	15-9 1,480	16-1 1,540	16-4 1,600	16-8 1,650	17-2 1,760	17-8 1,860
2 x 10	2 x 10	12.0	24-7 1,030	25-2 1,080	25-8 1,130	26-2 1,180	26-9 1,220	27-2 1,270	27-8 1,310	28-7 1,400	29-5 1,480
		16.0	22-4 1,140	22-10 1,190	23-4 1,240	23-10 1,290	24-3 1,340	24-8 1,390	25-2 1,440	25-11 1,540	26-9 1,630
		24.0	19-6 1,300	19-11 1,360	20-5 1,420	20-10 1,480	21-2 1,540	21-7 1,600	21-11 1,650	22-8 1,760	23-4 1,860
		12.0	31-4 1,030	32-1 1,080	32-9 1,130	33-5 1,180	34-1 1,220	34-8 1,270	35-4 1,310	36-5 1,400	37-6 1,480
		16.0	28-6 1,140	29-2 1,190	29-9 1,240	30-5 1,290	31-0 1,340	31-6 1,390	32-1 1,440	33-1 1,540	34-1 1,630
		24.0	24-10 1,300	25-5 1,360	26-0 1,420	26-6 1,480	27-1 1,540	27-6 1,600	28-0 1,650	28-11 1,760	29-9 1,860
		24.0	24.0	1,300	1,360	1,420	1,480	1,540	1,600	1,650	1,760
		24.0	24.0	1,300	1,360	1,420	1,480	1,540	1,600	1,650	1,760
		24.0	24.0	1,300	1,360	1,420	1,480	1,540	1,600	1,650	1,760

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The extreme fiber stress in bending, "F<sub>b</sub>," in pounds per square inch is shown below each span.

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**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4a**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**

**25 Lbs. per Sq. Ft. Live Load**

**For Use in Snow Load Zone 1**

**DESIGN CRITERIA:** Strength 25 lbs. per sq. ft. live load plus 10 lbs. per sq. ft. dead load determines fiber stress.

Deflection—For 25 lbs. per sq. ft. live load. Limited to span in inches divided by 180.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	6-7 .12	7-7 .18	8-6 .25	9-4 .33	10-0 .41	10-9 .50	11-5 .60	12-0 .70	12-7 .81	13-2 .92
		5-8 .10	6-7 .15	7-4 .21	8-1 .28	8-8 .36	9-4 .43	9-10 .52	10-5 .61	10-11 .70	11-5 .80
	24.0	4-8 .08	5-4 .13	6-0 .18	6-7 .23	7-1 .29	7-7 .35	8-1 .42	8-6 .50	8-11 .57	9-4 .65
		8-8 .12	10-0 .18	11-2 .25	12-3 .33	13-3 .41	14-2 .50	15-0 .60	15-10 .70	16-7 .81	17-4 .92
	16.0	7-6 .10	8-8 .15	9-8 .21	10-7 .28	11-6 .36	12-3 .43	13-0 .52	13-8 .61	14-4 .70	15-0 .80
		6-2 .08	7-1 .13	7-11 .18	8-8 .23	9-4 .29	10-0 .35	10-7 .42	11-2 .50	11-9 .57	12-3 .65
2 x 8	12.0	11-1 .12	12-9 .18	14-3 .25	15.8 .33	16-11 .41	18-1 .50	19-2 .60	20-2 .70	21-2 .81	22-1 .92
		9-7 .10	11-1 .15	12-4 .21	13-6 .28	14-8 .36	15-8 .43	16-7 .52	17-6 .61	18-4 .70	19-2 .80
	24.0	7-10 .08	9-0 .13	10-1 .18	11-1 .23	11-11 .29	12-9 .35	13-6 .42	14-3 .50	15-0 .57	15-8 .65
		13-6 .12	15-6 .18	17-4 .25	19-0 .33	20-7 .41	22-0 .50	23-4 .60	24-7 .70	25-9 .81	26-11 .92
	16.0	11-8 .10	13-5 .15	15-0 .21	16-6 .28	17-9 .36	19-0 .43	20-2 .52	21-3 .61	22-3 .70	23-3 .80
		9-6 0.08	11-0 0.13	12-3 0.18	13-5 0.23	14-6 0.29	15-6 0.35	16-6 0.42	17-4 0.50	18-3 0.57	19-0 0.65
(inches)	(inches)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
2 x 6	12.0	13-8 1.04	14-2 1.16	14-8 1.29	15-2 1.42	15-8 1.55	16-1 1.69	16-7 1.84	17-0 1.98	17-5 2.13	17-10 2.29
		11-10 .90	12-4 1.01	12-9 1.12	13-2 1.23	13-7 1.35	13-11 1.47	14-4 1.59	14-8 1.72	15-1 1.85	15-5 1.98
	24.0	9-8 .74	10-0 .82	10-5 .91	10-9 1.00	11-1 1.10	11-5 1.20	11-8 1.30	12-0 1.40	12-4 1.51	12-7 1.62
		18-0 1.04	18-9 1.16	19-5 1.29	20-0 1.42	20-8 1.55	21-3 1.69	21-10 1.84	22-4 1.98	22-11 2.13	23-6 2.29
	16.0	15-7 .90	16-3 1.01	16-9 1.12	17-4 1.23	17-10 1.35	18-5 1.47	18-11 1.59	19-5 1.72	19-10 1.85	20-4 1.98
		12-9 .74	13-3 .82	13-8 .91	14-2 1.00	14-7 1.10	15-0 1.20	15-5 1.30	15-10 1.40	16-3 1.51	16-7 1.62
2 x 8	12.0	23-0 1.04	23-11 1.16	24-9 1.29	25-6 1.42	26-4 1.55	27-1 1.69	27-10 1.84	28-7 1.98	28-3 2.13	30-0 2.29
		19-11 .90	20-8 1.01	21-5 1.12	22-1 1.23	22-10 1.35	23-5 1.47	24-1 1.59	24-9 1.72	25-4 1.85	25-11 1.98
	24.0	16-3 .74	16-11 .82	17-6 .91	18-1 1.00	18-7 1.10	19-2 1.20	19-8 1.30	20-2 1.40	20-8 1.51	21-2 1.62
		28-0 1.04	29-1 1.16	30-1 1.29	31-1 1.42	32-0 1.56	33-0 1.70	33-10 1.84	34-9 1.98	35-8 2.13	36-5 2.29
	16.0	24-3 .90	25.2 1.01	26-0 1.12	26-10 1.23	27-9 1.35	28-6 1.47	29-2 1.59	30-0 1.72	30-9 1.85	31-6 1.98
		19-10 0.74	20-7 0.82	21-3 0.91	22-0 1.01	22-8 1.10	23-4 1.20	23-11 1.30	24-7 1.41	25-2 1.51	25-9 1.62
2x 12	24.0	19-10 0.74	20-7 0.82	21-3 0.91	22-0 1.01	22-8 1.10	23-4 1.20	23-11 1.30	24-7 1.41	25-2 1.51	25-9 1.62

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

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NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4b**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**25 Lbs. per Sq. Ft. Live Load (Supporting Gypsum Wallboard Ceiling)**  
**For Use in Snow Load Zone 1**

**DESIGN CRITERIA:** Strength—25 Ibs. per sq.ft. live load plus 10 Ibs. per sq. ft. dead load determines fiber stress.

Deflection—For 25 Ibs. per sq. ft. live load. Limited to span in inches divided by 240.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	6-7 .15	7-7 .24	8-6 .33	9-4 .43	10-0 .55	10-9 .67	11-5 .80	12-0 .94	12-7 1.03	13-2 1.23
		5-8 .13	6-7 .20	7-4 .29	8-1 .38	8-8 .47	9-4 .58	9-10 .69	10-5 .81	10-11 .93	11-5 1.06
	24.0	4-8 .11	5-4 .17	6-0 .23	6-7 .31	7-1 .39	7-7 .47	8-1 .56	8-6 .66	8-11 .76	9-4 .87
		8-8 .15	10-0 .24	11-2 .33	12-3 .43	13-3 .55	14-2 .67	15-0 .80	15-10 .94	16-7 1.08	17-4 1.23
	16.0	7-6 .13	8-8 .20	9-8 .29	10-7 .38	11-6 .47	12-3 .58	13-0 .69	13-8 .81	14-4 .93	15-0 1.06
		6-2 .11	7-1 .17	7-11 .23	8-8 .31	9-4 .39	10-0 .47	10-7 .56	11-2 .66	11-9 .76	12-3 .87
	24.0	11-1 .15	12-9 .24	14-3 .33	15-8 .43	16-11 .55	18-1 .67	19-2 .80	20-2 .94	21-2 1.08	22-1 1.23
		9-7 .13	11-1 .20	12-4 .29	13-6 .38	14-8 .47	15-8 .58	16-7 .69	17-6 .81	18-4 .93	19-2 1.06
	24.0	7-10 .11	9-0 .17	10-1 .23	11-1 .31	11-11 .39	12-9 .47	13-6 .56	14-3 .66	15-0 .76	15-8 .87
		13-5 .15	15-6 .24	17-4 .33	19-0 .43	20-6 .55	21-11 .67	23-3 .80	24-7 .94	25-9 1.08	26-11 1.23
2 x 8	12.0	11-8 .13	13-5 .20	15-0 .29	16-6 .38	17-9 .47	19-0 .58	20-2 .69	21-3 .81	22-4 .93	23-3 1.06
		9-6 .11	11-0 .17	12-3 .23	13-5 .31	14-6 .39	15-6 .47	16-6 .56	17-4 .66	18-2 .76	19-0 .87
	24.0	9-6 .11	11-0 .17	12-3 .23	13-5 .31	14-6 .39	15-6 .47	16-6 .56	17-4 .66	18-2 .76	19-0 .87
		<b>1300</b>	<b>1400</b>	<b>1500</b>	<b>1600</b>	<b>1700</b>	<b>1800</b>	<b>1900</b>	<b>2000</b>	<b>2100</b>	<b>2200</b>
2 x 10	12.0	13-8 1.39	14-2 1.55	14-8 1.72	15-2 1.89	15-8 2.07	16-1 2.26	16-7 2.45	17-0 2.65	17-5 2.85	17-10 3.06
		11-10 1.20	12-4 1.34	12-9 1.49	13-2 1.64	13-7 1.80	13-11 1.96	14-4 2.12	14-8 2.29	15-1 2.46	15-5 2.64
	24.0	9-8 .98	10-0 1.10	10-5 1.21	10-9 1.34	11-1 1.47	11-5 1.60	11-8 1.73	12-0 1.87	12-4 2.01	12-7 2.16
		18-0 1.39	18-9 1.55	19-5 1.72	20-0 1.89	20-8 2.07	21-3 2.26	21-10 2.45	22-5 2.65	22-11 2.85	23-6 3.06
	16.0	15-7 1.20	16-3 1.34	16-9 1.49	17-4 1.64	17-10 1.80	18-5 1.96	18-11 2.12	19-5 2.29	19-10 2.46	20-4 2.64
		12-9 .98	13-3 1.10	13-8 1.21	14-2 1.34	14-7 1.47	15-0 1.60	15-5 1.73	15-10 1.87	16-3 2.01	16-7 2.16
	24.0	23-0 1.39	23-11 1.55	24-9 1.72	25-6 1.89	26-4 2.07	27-2 2.26	27-10 2.45	28-7 2.65	29-3 2.85	29-11 3.06
		19-11 1.20	20-8 1.34	21-5 1.49	22-1 1.64	22-10 1.80	23-5 1.96	24-1 2.12	24-9 2.29	25-4 2.46	25-11 2.64
	24.0	16-3 .98	16-11 1.10	17-6 1.21	18-1 1.34	18-7 1.47	19-2 1.60	19-8 1.73	20-2 1.87	20-8 2.01	21-2 2.16
		28-0 1.39	29-1 1.55	30-1 1.72	31-1 1.89	32-0 2.07	32-11 2.26	33-9 2.45	34-9 2.65	35-7 2.85	36-6 3.06
2 x 12	12.0	24-3 1.20	25-2 1.34	26-0 1.49	26-10 1.64	27-9 1.80	28-6 1.96	29-4 2.12	30-1 2.29	30-9 2.46	31-6 2.64
		19-10 .98	20-6 1.10	21-3 1.21	21-11 1.34	22-8 1.47	23-3 1.60	23-11 1.73	24-7 1.87	25-2 2.01	25-9 2.16
	24.0	19-10 .98	20-6 1.10	21-3 1.21	21-11 1.34	22-8 1.47	23-3 1.60	23-11 1.73	24-7 1.87	25-2 2.01	25-9 2.16

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NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

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**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4c**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**25 Lbs. per Sq. Ft. Live Load (Supporting Veneer Plaster Ceiling)**  
**For Use in Snow Load Zone 1**

**DESIGN CRITERIA:** Strength-25 lbs. per sq.ft. live load plus 10 lbs. per sq. ft. dead load determines fiber stress.

Deflection—For 25 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	6-7 .23	7-7 .35	8-6 .50	9-4 .65	10-0 .82	10-9 1.00	11-5 1.20	12-0 1.40	12-7 1.62	13-2 1.84
		5-8 .20	6-7 .31	7-4 .43	8-1 .56	8-8 .71	9-4 .87	9-10 1.04	10-5 1.21	10-11 1.40	11-5 1.60
		4-8 .16	5-4 .25	6-0 .35	6-7 .46	7-1 .58	7-7 .71	8-1 .85	8-6 .99	8-11 1.14	9-4 1.30
	12.0	8-8 .23	10-0 .35	11-2 .50	12-3 .65	13-3 .82	14-2 1.00	15-0 1.20	15-10 1.40	16-7 1.62	17-4 1.84
		7-6 .20	8-8 .31	9-8 .43	10-7 .56	11-6 .71	12-3 .87	13-0 1.04	13-8 1.21	14-4 1.40	15-0 1.60
		6-2 .16	7-1 .25	7-11 .35	8-8 .46	9-4 .58	10-0 .71	10-7 .85	11-2 .99	11-9 1.14	12-3 1.30
	16.0	11-1 .23	12-9 .35	14-3 .50	15-8 .65	16-11 .82	18-1 1.00	19-2 1.20	20-2 1.40	21-2 1.62	22-1 1.84
		9-7 .20	11-1 .31	12-4 .43	13-6 .56	14-8 .71	15-8 .87	16-7 1.04	17-6 1.21	18-4 1.40	19-2 1.60
		7-10 .16	9-0 .25	10-1 .35	11-1 .46	11-11 .58	12-9 .71	13-6 .85	14-3 .99	15-0 1.14	15-8 1.30
2 x 8	24.0	13-5 .23	15-6 .35	17-4 .50	19-0 .65	20-6 .82	21-11 1.00	23-3 1.20	24-7 1.40	25-9 1.62	26-11 1.84
		11-8 .20	13-5 .31	15-0 .43	16-6 .56	17-9 .71	19-0 .87	20-2 1.04	21-3 1.21	22-4 1.40	23-3 1.60
	12.0	9-6 .16	11-0 .25	12-3 .35	13-5 .46	14-6 .58	15-6 .71	16-6 .85	17-4 .99	18-2 1.14	19-0 1.30
	16.0	1.47	1.64	1.82	2.01	2.20	2.40	2.60	2.81	3.02	3.24
2x 12	12.0	18-0 2.08	18-9 2.32	19-5 2.58	20-0 2.84	20-8 3.11	21-3 3.39	21-10 3.68	22-5 3.97	22-11 4.28	23-6 4.58
		15-7 1.80	16-3 2.01	16-9 2.23	17-4 2.46	17-10 2.69	18-4 2.93	18-10 3.18	19-4 3.44	19-10 3.70	20-4 3.96
		12-9 1.47	13-3 1.64	13-8 1.82	14-2 2.01	14-7 2.20	15-0 2.40	15-5 2.60	15-10 2.81	16-3 3.02	16-7 3.24
	16.0	23-0 2.08	23-11 2.32	24-9 2.58	25-7 2.84	26-4 3.11	27-2 3.39	27-10 3.68	28-7 3.97	29-3 4.28	29-11 4.59
		19-11 1.80	20-8 2.01	21-5 2.23	22-1 2.46	22-9 2.69	23-5 2.93	24-1 3.18	24-9 3.44	25-4 3.70	25-11 3.97
		16-3 1.47	16-11 1.64	17-6 1.82	18-1 2.01	18-7 2.10	19-2 2.40	19-8 2.60	20-2 2.81	20-8 3.02	21-2 3.24
	24.0	28-0 2.08	29-1 2.33	30-2 2.58	31-1 2.84	32-0 3.11	32-11 3.39	33-11 3.68	34-9 3.97	35-7 4.28	36-5 4.59
		24-3 1.80	25-2 2.01	26-0 2.23	26-11 2.46	27-9 2.69	28-6 2.93	29-4 3.18	30-1 3.44	30-10 3.70	31-6 3.97
		19-10 1.47	20-6 1.64	21-3 1.82	21-11 2.01	22-8 2.20	23-3 2.40	23-11 2.60	24-7 2.81	25-2 3.02	25-9 3.24

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NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4d**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**

**25 Lbs. per Sq. Ft. Live Load**

**For Use in Snow Load Zone 1**

**DESIGN CRITERIA:** Strength—25 lbs. per sq. ft. live load plus 15 lbs. per sq. ft. dead load determines fiber stress.

Deflection—For 25 lbs. per sq. ft. live load. Limited to span in inches divided by 180.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	6-2 0.09	7-1 0.15	7-11 0.20	8-8 0.27	9-5 0.34	10-0 0.41	10-8 0.49	11-3 0.57	11-9 0.66	12-4 0.75
		5-4 .08	6-2 .13	6-10 .18	7-6 .23	8-2 .29	8-8 .36	9-3 .42	9-9 .50	10-2 .57	10-8 .65
	24.0	4-4 .07	5-0 .10	5-7 .14	6-2 .19	6-8 .24	7-1 .29	7-6 .35	7-11 .41	8-4 .47	8-8 .53
		8-1 .09	9-4 .15	10-6 .20	11-6 .27	12-5 .34	13-3 .41	14-0 .49	14-10 .57	15-6 .66	16-3 .75
	16.0	7-0 .08	8-1 .13	9-1 .18	9-11 .23	10-9 .29	11-6 .36	12-2 .42	12-10 .50	13-5 .57	14-0 .65
		5-9 .07	6-7 .10	7-5 .14	8-1 .19	8-9 .24	9-4 .29	9-11 .35	10-6 .41	11-0 .47	11-6 .53
	24.0	10-4 .09	11-11 .15	13-4 .20	14-8 .27	15-10 .34	16-11 .41	17-11 .49	18-11 .57	19-10 .66	20-8 .75
		8-11 .08	10-4 .13	11-7 .18	12-8 .23	13-8 .29	14-8 .36	15-6 .42	16-4 .50	17-2 .57	17-11 .65
	24.0	7-4 .07	8-5 .10	9-5 .14	10-4 .19	11-2 .24	11-11 .29	12-8 .35	13-4 .41	14-0 .47	14-8 .53
		12-7 .09	14-6 .15	16-3 .20	17-9 .27	19-3 .34	20-6 .41	21-9 .49	23-0 .57	24-1 .66	25-2 .75
2 x 8	12.0	10-11 .08	12-7 .13	14-1 .18	15-5 .23	16-8 .29	17-9 .36	18-10 .42	19-11 .50	20-10 .57	21-9 .65
		8-11 .07	10-3 .10	11-6 .14	12-7 .19	13-7 .24	14-6 .29	15-5 .35	16-3 .41	17-0 .47	17-9 .53
	24.0	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
		12-10 .85	13-3 .95	13-9 1.05	14-2 1.16	14-8 1.27	15-1 1.39	15-6 1.50	15-11 1.62	16-3 1.75	16-8 1.87
2 x 10	12.0	11-1 .74	11-6 .82	11-11 .91	12-4 1.01	12-8 1.10	13-1 1.20	13-5 1.30	13-9 1.41	14-1 1.51	14-5 1.63
		9-1 .60	9-5 .67	9-9 .75	10-0 .82	10-4 .90	10-8 .98	10-11 1.06	11-3 1.15	11-6 1.24	11-9 1.32
	16.0	16-10 .85	17-6 .95	18-1 1.05	18-9 1.16	19-4 1.27	19-10 1.39	20-5 1.50	20-11 1.62	21-11 1.75	21-11 1.87
		14-7 .74	15-2 .82	15-8 .91	16-3 1.01	16-9 1.10	17-2 1.20	17-8 1.30	18-1 1.41	18-7 1.51	19-0 1.63
2 x 12	24.0	11-11 .60	12-5 .67	12-10 .75	13-3 .82	13-8 .90	14-0 .98	14-5 1.06	14-10 1.15	15-2 1.24	15-6 1.32
		21-6 .85	22-4 .95	23-1 1.05	23-11 1.16	24-7 1.27	25-4 1.39	26-0 1.50	26-8 1.62	27-4 1.75	28-0 1.87
	16.0	18-8 .74	19-4 .82	20-0 .91	20-8 1.01	21-4 1.10	21-11 1.20	22-6 1.30	23-1 1.41	23-8 1.51	24-3 1.63
		15-3 .60	15-10 .67	16-4 .75	16-11 .82	17-5 .90	17-11 .98	18-5 1.06	18-11 1.15	19-4 1.24	19-9 1.32
2 x 14	12.0	26-2 0.85	27-2 0.95	28-2 1.05	29-1 1.16	29-11 1.27	30-10 1.39	31-8 1.50	32-6 1.62	33-3 1.75	34-1 1.87
		22-8 0.74	23-6 0.83	24-4 0.92	25-2 1.01	25-11 1.10	26-8 1.20	27-5 1.30	28-2 1.41	28-10 1.51	29-6 1.63
	16.0	18-6 0.60	19-2 0.67	19-10 0.75	20-6 0.82	21-2 0.90	21-9 0.98	22-4 1.06	22-11 1.15	23-6 1.24	24-1 1.32
		24.0	0.60	0.67	0.75	0.82	0.90	0.98	1.06	1.15	1.24

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**

**THE MASSACHUSETTS STATE BUILDING CODE**

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4e**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**25 Lbs. per Sq. Ft. Live Load (Supporting Gypsum Wallboard Ceiling)**  
**For Use in Snow Load Zone 1**

**DESIGN CRITERIA:** Strength-25 lbs. per sq. ft. live load plus 15 lbs. per sq. ft. dead load determines fiber stress.

Deflection—For 25 lbs. per sq. ft. live load. Limited to span in inches divided by 240.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	6-2 .13	7-1 .19	7-11 .27	8-8 .36	9-5 .45	10-0 .55	10-8 .65	11-3 .77	11-9 .88	12-4 1.01
		5-4 .11	6-2 .17	6-10 .23	7-6 .31	8-2 .39	8-8 .47	9-3 .57	9-9 .66	10-2 .76	10-8 .87
	24.0	4-4 .09	5-0 .14	5-7 .19	6-2 .25	6-8 .32	7-1 .39	7-6 .46	7-11 .54	8-4 .62	8-8 .71
		8-1 .13	9-4 .19	10-6 .27	11-6 .36	12-5 .45	13-3 .55	14-0 .65	14-10 .77	15-6 .88	16-3 1.01
	16.0	7-0 .11	8-1 .17	9-1 .23	9-11 .31	10-9 .39	11-6 .47	12-2 .57	12-10 .66	13-5 .76	14-0 .87
		5-9 .09	6-7 .14	7-5 .19	8-1 .25	8-9 .32	9-4 .39	9-11 .46	10-6 .54	11-0 .62	11-6 .71
2 x 8	12.0	10-4 .13	11-11 .19	13-4 .27	14-8 .36	15-10 .45	16-11 .55	17-11 .65	18-11 .77	19-10 .88	20-8 1.01
		8-11 .11	10-4 .17	11-7 .23	12-8 .31	13-8 .39	14-8 .47	15-6 .57	16-4 .66	17-2 .76	17-11 .87
	24.0	7-4 .09	8-5 .14	9-5 .19	10-4 .25	11-2 .32	11-11 .39	12-8 .46	13-4 .54	14-0 .62	14-8 .71
		12-7 .13	14-6 .19	16-3 .23	17-9 .36	19-3 .45	20-6 .55	21-9 .65	23-0 .77	24-1 .88	25-2 1.01
	16.0	10-11 .11	12-7 .17	14-1 .23	15-5 .31	16-8 .39	17-9 .47	18-10 .57	19-11 .66	20-10 .76	21-9 .87
		8-11 .09	10-3 .14	11-6 .19	12-7 .25	13-7 .32	14-6 .39	15-5 .46	16-3 .54	17-0 .62	17-9 .71
(inches)	(inches)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
2 x 6	12. 0	12-10 1.13	13-3 1.27	13-9 1.41	14-2 1.55	14-8 1.70	15-1 1.85	15-6 2.00	15-11 2.17	16-3 2.33	16-8 2.5
		11-1 0.98	11-6 1.10	11-11 1.22	12-4 1.34	12-8 1.47	13-1 1.60	13-5 1.74	13-9 1.88	14-1 2.02	14-5 2.17
	16.0	9-1 0.80	9-5 0.90	9-9 0.99	10-0 1.10	10-4 1.20	10-8 1.31	10-11 1.42	11-3 1.53	11-6 1.65	11-9 1.77
		16-10 1.13	17-6 1.27	18-1 1.41	18-9 1.55	19-4 1.70	19-10 1.85	20-5 2.00	20-11 2.17	21-6 2.33	21-11 2.50
	16.0	14-7 0.98	15-2 1.10	15-8 1.22	16-3 1.34	16-9 1.47	17-2 1.60	17-8 1.74	18-1 1.88	18-7 2.02	19-0 2.17
		11-11 0.80	12-5 0.90	12-10 0.99	13-3 1.10	13-8 1.20	14-0 1.31	14-5 1.42	14-10 1.53	15-2 1.65	15-5 1.77
2 x 8	12.0	21-6 1.13	22-4 1.27	23-1 1.41	23-11 1.55	24-7 1.70	25-4 1.85	26-0 2.00	26-9 2.17	27-4 2.33	28-0 2.50
		18-8 0.98	19-4 1.10	20-0 1.22	20-8 1.34	21-4 1.47	21-11 1.60	22-6 1.74	23-1 1.88	23-8 2.02	24-3 2.17
	16.0	15-3 0.80	15-10 0.90	16-4 0.99	16-11 1.10	17-5 1.20	17-11 1.31	18-5 1.42	18-11 1.53	19-4 1.65	19-10 1.77
		26-2 1.13	27-2 1.27	28-2 1.41	29-1 1.55	29-11 1.70	30-10 1.85	31-8 2.00	32-6 2.17	33-3 2.33	34-1 2.50
	16.0	22-8 0.98	23-6 1.10	24-4 1.22	25-2 1.34	25-11 1.47	26-8 1.60	27-5 1.74	28-1 1.88	28-10 2.02	29-6 2.17
		18-6 0.80	19-3 0.90	19-11 .99	20-6 1.10	21-2 1.20	21-9 1.31	22-5 1.42	23-0 1.53	23-6 1.65	24-1 1.77
2x 12	24.0	26-2 0.80	27-2 0.90	28-2 .99	29-1 1.10	29-11 1.20	30-10 1.31	31-8 1.42	32-6 1.53	33-3 1.65	34-1 1.77

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**

**THE MASSACHUSETTS STATE BUILDING CODE**

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS  
ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION

**TABLE 3608.2.4f**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**25 Lbs. per Sq. Ft. Live Load (Supporting Veneer Plaster Ceiling)**  
**For Use in Snow Load Zone 1**

**DESIGN CRITERIA:** Strength-25 lbs. per sq. ft. live load plus 15 lbs. per sq. ft. dead load determines fiber stress.

Deflection—For 25 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	6-2 .19	7-1 .29	7-11 .41	8-8 .53	9-5 .67	10-0 .82	10-8 .98	11-3 1.15	11-9 1.32	12-4 1.51
	16.0	5-4 .16	6-2 .25	6-10 .35	7-6 .46	8-2 .58	8-8 .71	9-3 .85	9-9 .99	10-2 1.15	10-8 1.31
	24.0	4-4 .13	5-0 .21	5-7 .29	6-2 .38	6-8 .48	7-1 .58	7-6 .69	7-11 .81	8-4 .94	8-8 1.07
	12.0	8-1 .19	9-4 .29	10-6 .41	11-6 .53	12-5 .67	13-3 .82	14-0 .98	14-10 1.15	15-6 1.32	16-3 1.51
	16.0	7-0 .16	8-1 .25	9-1 .35	9-11 .46	10-9 .58	11-6 .71	12-2 .85	12-10 .99	13-5 1.15	14-0 1.31
	24.0	5-9 .13	6-7 .21	7-5 .29	8-1 .38	8-9 .48	9-4 .58	9-11 .69	10-6 .81	11-0 .94	11-6 1.07
2 x 8	12.0	10-4 .19	11-11 .29	13-4 .41	14-8 .53	15-10 .67	16-11 .82	17-11 .98	18-11 1.15	19-10 1.32	20-8 1.51
	16.0	8-11 .16	10-4 .25	11-7 .35	12-8 .46	13-8 .58	14-8 .71	15-6 .85	16-4 .99	17-2 1.15	17-11 1.31
	24.0	7-4 .13	8-5 .21	9-5 .29	10-4 .38	11-2 .48	11-11 .58	12-8 .69	13-4 .81	14-0 .94	14-8 1.07
	12.0	12-7 .19	14-6 .29	16-3 .41	17-9 .53	19-3 .67	20-6 .82	21-9 .98	23-0 1.15	24-1 1.32	25-2 1.51
	16.0	10-11 .16	12-7 .25	14-1 .35	15-5 .46	16-8 .58	17-9 .71	18-10 .85	19-11 .99	20-10 1.15	21-9 1.31
	24.0	8-11 .13	10-3 .21	11-6 .29	12-7 .38	13-7 .48	14-6 .58	15-5 .69	16-3 .81	17-0 .94	17-9 1.07
(inches)	(inches)	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
2 x 6	12.0	12-10 1.70	13-3 1.90	13-9 2.11	14-2 2.32	14-8 2.55	15-1 2.77	15-6 3.01	15-10 3.25	16-3 3.49	16-8 3.75
	16.0	11-1 1.47	.46 1.65	11-11 1.83	12-4 2.01	12-8 2.20	13-1 2.40	13-5 2.61	13-9 2.82	14-1 3.03	14-5 3.25
	24.0	9-1 1.20	9-5 1.34	9-9 1.49	10-0 1.64	10-4 1.80	10-8 1.96	10-11 2.13	11-3 2.30	11-6 2.47	11-9 2.65
	12.0	16-10 1.70	17-6 1.90	18-1 2.11	18-9 2.32	19-4 2.55	19-10 2.77	20-5 3.01	20-11 3.25	21-5 3.49	21-11 3.75
	16.0	14-7 1.47	15-2 1.65	15-8 1.83	16-3 2.01	16-9 2.20	17-2 2.40	17-8 2.61	18-2 2.82	18-7 3.03	19-0 3.25
	24.0	11-11 1.20	12-5 1.34	12-10 1.49	13-3 1.64	13-8 1.80	14-0 1.96	14-5 2.13	14-10 2.30	15-2 2.47	15-6 2.65
2 x 8	12.0	21-6 1.70	22-4 1.90	23-1 2.11	23-11 2.32	24-7 2.55	25-4 2.77	26-0 3.01	26-9 3.25	27-4 3.49	28-0 3.75
	16.0	18-8 1.47	19-4 1.65	20-0 1.83	20-8 2.01	21-4 2.20	21-11 2.40	22-6 2.61	23-2 2.82	23-9 3.03	24-3 3.25
	24.0	15-3 1.20	15-10 1.34	16-4 1.49	16-11 1.64	17-5 1.80	17-11 1.96	18-5 2.13	18-11 2.30	19-4 2.47	19-10 2.65
	12.0	26-2 1.70	27-2 1.90	28-2 2.11	29-1 2.32	29-11 2.55	30-10 2.77	31-8 3.01	32-6 3.25	33-3 3.49	34-1 3.75
	16.0	22-8 1.47	23-6 1.65	24-4 1.83	25-2 2.01	25-11 2.20	26-8 2.40	27-5 2.61	28-2 2.82	28-10 3.03	29-6 3.25
	24.0	18-6 1.20	19-3 1.34	19-11 1.49	20-6 1.64	21-2 1.80	21-9 1.96	22-5 2.13	23-0 2.30	23-6 2.47	24-1 2.65
2 x 10	12.0	26-2 1.70	27-2 1.90	28-2 2.11	29-1 2.32	29-11 2.55	30-10 2.77	31-8 3.01	32-6 3.25	33-3 3.49	34-1 3.75
	16.0	22-8 1.47	23-6 1.65	24-4 1.83	25-2 2.01	25-11 2.20	26-8 2.40	27-5 2.61	28-2 2.82	28-10 3.03	29-6 3.25
	24.0	18-6 1.20	19-3 1.34	19-11 1.49	20-6 1.64	21-2 1.80	21-9 1.96	22-5 2.13	23-0 2.30	23-6 2.47	24-1 2.65
	12.0	26-2 1.70	27-2 1.90	28-2 2.11	29-1 2.32	29-11 2.55	30-10 2.77	31-8 3.01	32-6 3.25	33-3 3.49	34-1 3.75
	16.0	22-8 1.47	23-6 1.65	24-4 1.83	25-2 2.01	25-11 2.20	26-8 2.40	27-5 2.61	28-2 2.82	28-10 3.03	29-6 3.25
	24.0	18-6 1.20	19-3 1.34	19-11 1.49	20-6 1.64	21-2 1.80	21-9 1.96	22-5 2.13	23-0 2.30	23-6 2.47	24-1 2.65

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NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4g**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**

**30 Lbs. per Sq. Ft. Live Load**  
**For Use in Snow Load Zone 2**

**DESIGN CRITERIA:** Strength—10 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 180.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)										
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 6	12.0	6-2 0.11	7-1 0.17	7-11 0.24	8-8 0.32	9-4 0.40	10-0 0.49	10-8 0.59	11-3 0.69	11-9 0.80	12-4 0.91	12-9 1.02
		5-4 0.10	6-2 0.15	6-10 0.21	7-6 0.28	8-2 0.35	8-8 0.43	9-3 0.51	9-9 0.60	10-2 0.69	10-8 0.78	11-1 0.88
	16.0	4-4 0.08	5-0 0.12	5-8 0.17	6-2 0.23	6-8 0.29	7-1 0.35	7-6 0.42	7-11 0.49	8-4 0.56	8.8 0.64	9-1 0.72
		8-1 0.11	9-4 0.17	10-6 0.24	11-6 0.32	12-4 0.40	13-3 0.49	14-1 0.59	14-10 0.69	15-6 0.80	16-3 0.91	16-10 1.02
	24.0	7-0 0.08	8-1 0.12	9-1 0.17	9-11 0.23	10-9 0.29	11-6 0.35	12-2 0.43	12-10 0.51	13-6 0.60	14-1 0.69	14-8 0.78
		5-9 0.08	6-8 0.12	7-5 0.17	8-1 0.23	8-9 0.29	9-4 0.35	9-11 0.42	10-6 0.49	11-0 0.56	11-6 0.64	11-11 0.72
2 x 8	12.0	10-4 0.11	11-11 0.17	13-4 0.24	14-8 0.32	15-10 0.40	16-11 0.49	17-11 0.59	18-11 0.69	19-11 0.80	20-8 0.91	21-6 1.02
		8-11 0.10	10-4 0.15	11-7 0.21	12-8 0.28	13-8 0.35	14-8 0.43	15-6 0.51	16-4 0.60	17-2 0.69	17-11 0.78	18-8 0.88
	16.0	7-4 0.08	8.5 0.12	9-5 0.17	10-4 0.23	11-2 0.29	11-11 0.35	12-8 0.42	13-4 0.49	14-0 0.56	14-8 0.64	15-3 0.72
		24.0 0.08	7-4 0.12	8.5 0.17	9-5 0.23	10-4 0.29	11-2 0.35	11-11 0.42	12-8 0.49	13-4 0.56	14-0 0.64	15-3 0.72
	24.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		10-11 0.10	12-7 0.15	14-1 0.21	15-5 0.28	16-8 0.35	17-10 0.43	18-10 0.51	19-11 0.60	20-10 0.69	21-10 0.78	22-8 0.88
2 x 10	12.0	8-10 0.08	10-3 0.12	11-6 0.17	12-7 0.23	13-7 0.29	14-6 0.35	15-5 0.42	16-3 0.49	17-0 0.56	17-9 0.64	18-6 0.72
		24.0 0.08	7-4 0.12	8.5 0.17	9-5 0.23	10-4 0.29	11-2 0.35	11-11 0.42	12-8 0.49	13-4 0.56	14-0 0.64	15-3 0.72
	16.0	12.0 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		24.0 0.10	10-11 0.15	12-7 0.21	14-1 0.28	15-5 0.35	16-8 0.43	17-10 0.51	18-10 0.60	19-11 0.69	20-10 0.78	21-10 0.88
	24.0	8-10 0.08	10-3 0.12	11-6 0.17	12-7 0.23	13-7 0.29	14-6 0.35	15-5 0.42	16-3 0.49	17-0 0.56	17-9 0.64	18-6 0.72
		12.0 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
2 x 12	12.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		16.0 0.10	10-11 0.15	12-7 0.21	14-1 0.28	15-5 0.35	16-8 0.43	17-10 0.51	18-10 0.60	19-11 0.69	20-10 0.78	21-10 0.88
	24.0	8-10 0.08	10-3 0.12	11-6 0.17	12-7 0.23	13-7 0.29	14-6 0.35	15-5 0.42	16-3 0.49	17-0 0.56	17-9 0.64	18-6 0.72
		24.0 0.08	7-4 0.12	8.5 0.17	9-5 0.23	10-4 0.29	11-2 0.35	11-11 0.42	12-8 0.49	13-4 0.56	14-0 0.64	15-3 0.72
	12.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		16.0 0.10	10-11 0.15	12-7 0.21	14-1 0.28	15-5 0.35	16-8 0.43	17-10 0.51	18-10 0.60	19-11 0.69	20-10 0.78	21-10 0.88
2 x 6	16.0	8-10 0.09	10-3 0.14	11-6 0.21	12-7 0.28	13-7 0.35	14-6 0.42	15-5 0.49	16-3 0.56	17-0 0.63	17-9 0.70	18-6 0.78
		24.0 0.09	7-4 0.14	8.5 0.21	9-5 0.28	10-4 0.35	11-2 0.42	11-11 0.49	12-8 0.56	13-4 0.63	14-0 0.70	15-3 0.78
	12.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		24.0 0.11	7-4 0.17	8.5 0.24	9-5 0.31	10-4 0.38	11-2 0.45	11-11 0.52	12-8 0.59	13-4 0.66	14-0 0.73	15-3 0.81
	16.0	12-7 0.10	14-6 0.16	16-3 0.23	17-9 0.30	19-3 0.38	20-6 0.45	21-10 0.52	22-11 0.62	24-1 0.70	25-2 0.78	26-2 0.86
		24.0 0.10	7-4 0.16	8.5 0.23	9-5 0.30	10-4 0.37	11-2 0.44	11-11 0.51	12-8 0.58	13-4 0.65	14-0 0.72	15-3 0.80
2 x 8	12.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		16.0 0.10	10-11 0.15	12-7 0.21	14-1 0.28	15-5 0.35	16-8 0.43	17-10 0.51	18-10 0.60	19-11 0.69	20-10 0.78	21-10 0.88
	24.0	8-10 0.09	10-3 0.14	11-6 0.21	12-7 0.28	13-7 0.35	14-6 0.42	15-5 0.49	16-3 0.56	17-0 0.63	17-9 0.70	18-6 0.78
		24.0 0.09	7-4 0.14	8.5 0.21	9-5 0.28	10-4 0.35	11-2 0.42	11-11 0.49	12-8 0.56	13-4 0.63	14-0 0.70	15-3 0.78
	12.0	12-7 0.10	14-6 0.16	16-3 0.23	17-9 0.30	19-3 0.38	20-6 0.45	21-10 0.52	22-11 0.62	24-1 0.70	25-2 0.78	26-2 0.86
		24.0 0.10	7-4 0.16	8.5 0.23	9-5 0.30	10-4 0.37	11-2 0.44	11-11 0.51	12-8 0.58	13-4 0.65	14-0 0.72	15-3 0.80
2 x 10	12.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		16.0 0.10	10-11 0.15	12-7 0.21	14-1 0.28	15-5 0.35	16-8 0.43	17-10 0.51	18-10 0.60	19-11 0.69	20-10 0.78	21-10 0.88
	24.0	8-10 0.09	10-3 0.14	11-6 0.21	12-7 0.28	13-7 0.35	14-6 0.42	15-5 0.49	16-3 0.56	17-0 0.63	17-9 0.70	18-6 0.78
		24.0 0.09	7-4 0.14	8.5 0.21	9-5 0.28	10-4 0.35	11-2 0.42	11-11 0.49	12-8 0.56	13-4 0.63	14-0 0.70	15-3 0.78
	12.0	12-7 0.10	14-6 0.16	16-3 0.23	17-9 0.30	19-3 0.38	20-6 0.45	21-10 0.52	22-11 0.62	24-1 0.70	25-2 0.78	26-2 0.86
		24.0 0.10	7-4 0.16	8.5 0.23	9-5 0.30	10-4 0.37	11-2 0.44	11-11 0.51	12-8 0.58	13-4 0.65	14-0 0.72	15-3 0.80
2 x 12	12.0	12-7 0.11	14-6 0.17	16-3 0.24	17-9 0.32	19-3 0.40	20-6 0.49	21-10 0.59	22-11 0.69	24-1 0.80	25-2 0.91	26-2 1.02
		16.0 0.10	10-11 0.15	12-7 0.21	14-1 0.28	15-5 0.35	16-8 0.43	17-10 0.51	18-10 0.60	19-11 0.69	20-10 0.78	21-10 0.88
	24.0	8-10 0.09	10-3 0.14	11-6 0.21	12-7 0.28	13-7 0.35	14-6 0.42	15-5 0.49	16-3 0.56	17-0 0.63	17-9 0.70	18-6 0.78
		24.0 0.09	7-4 0.14	8.5 0.21	9-5 0.28	10-4 0.35	11-2 0.42	11-11 0.49	12-8 0.56	13-4 0.63	14-0 0.70	15-3 0.78
	12.0	12-7 0.10	14-6 0.16	16-3 0.23	17-9 0.30	19-3 0.38	20-6 0.45	21-10 0.52	22-11 0.62	24-1 0.70	25-2 0.78</td	

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**

**THE MASSACHUSETTS STATE BUILDING CODE**

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS  
ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION

**TABLE 3608.2.4h**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**30 Lbs. per Sq. Ft. Live Load (Supporting Gypsum Ceiling)**  
**For Use in Snow Load Zone 2**

**DESIGN CRITERIA:** Strength—10 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 240.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)										
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 6	12.0	6-2 0.15	7-1 0.23	7-11 0.32	8-8 0.43	9-5 0.54	10-0 0.66	10-8 0.78	11-3 0.92	11-9 1.06	124 1.21	12-10 1.36
		5-4 0.13	6-2 0.20	6-11 0.28	7-6 0.37	8-2 0.47	8-8 0.57	9-3 0.68	9- 9 0.80	10-2 0.92	10-8 1.05	11-1 1.18
	16.0	4-4 0.11	5-0 0.16	5-7 0.23	6-2 0.30	6-8 0.38	7-1 0.46	7-6 0.55	7-11 0.65	8-4 0.75	8-8 0.85	9-1 0.96
		8-1 0.15	9-4 0.23	10-6 0.32	11-6 0.43	12-5 0.54	13-3 0.66	14-0 0.78	14-10 0.92	15-6 1.06	16-3 1.21	16-10 1.36
	24.0	7-0 0.13	8-1 0.20	9-1 0.28	9-11 0.37	10-9 0.47	11-6 0.57	12-2 0.68	12-10 0.80	13-5 0.92	14-0 1.05	14-7 1.18
		5-9 0.11	6-7 0.16	7-5 0.23	8-1 0.30	8-9 0.38	9-4 0.46	9-11 0.55	10-6 0.65	11-0 0.75	11-6 0.85	11-11 0.96
2 x 8	12.0	10-4 0.15	11-11 0.23	13-4 0.32	14-8 0.43	15-10 0.54	16-11 0.66	17-11 0.78	18-11 0.92	19-10 1.06	20-8 1.21	21-6 1.36
		8-11 0.13	10-4 0.20	11-7 0.28	12-8 0.37	13-8 0.47	14-8 0.57	15-6 0.68	16-4 0.80	17-2 0.92	17-11 1.05	18-8 1.18
	16.0	7-4 0.11	8-5 0.16	9-5 0.23	10-4 0.30	11-2 0.38	11-11 0.46	12-8 0.55	134 0.65	14-0 0.75	14-8 0.85	15-3 0.96
		24.0 0.11	7-4 0.16	8-5 0.23	9-5 0.30	10-4 0.38	11-2 0.46	11-11 0.55	12-8 0.65	134 0.75	14-0 0.85	15-3 0.96
	24.0	12-7 0.15	14-6 0.23	16-3 0.32	17-9 0.43	19-3 0.54	20-6 0.66	21-9 0.78	23-0 0.92	24-1 1.06	25-2 1.21	26-2 1.36
		10-11 0.13	12-7 0.20	14-1 0.28	15-5 0.37	16-8 0.47	17-9 0.57	18-10 0.68	19-11 0.80	20-10 0.92	21-9 1.05	22-8 1.18
2 x 10	12.0	8-11 0.11	10-3 0.16	11-6 0.23	12-7 0.30	13-7 0.38	14-6 0.46	15-5 0.55	16-3 0.65	17-0 0.75	17-9 0.85	18-6 0.96
		24.0 0.11	7-4 0.16	8-5 0.23	9-5 0.30	10-4 0.38	11-2 0.46	11-11 0.55	12-8 0.65	134 0.75	14-0 0.85	15-3 0.96
	16.0	12.0 0.15	14.6 0.23	16.3 0.32	17.9 0.43	19.3 0.54	20.6 0.66	21.9 0.78	23.0 0.92	24.1 1.06	25.2 1.21	26.2 1.36
		24.0 0.13	10-11 0.20	12-7 0.28	14-1 0.37	15-5 0.47	16-8 0.57	17-9 0.68	18-10 0.80	19-11 0.92	20-10 1.05	21-9 1.18
	24.0	8-11 0.11	10-3 0.16	11-6 0.23	12-7 0.30	13-7 0.38	14-6 0.46	15-5 0.55	16-3 0.65	17-0 0.75	17-9 0.85	18-6 0.96
		12.0 0.15	14.6 0.23	16.3 0.32	17.9 0.43	19.3 0.54	20.6 0.66	21.9 0.78	23.0 0.92	24.1 1.06	25.2 1.21	26.2 1.36
2 x 12	12.0	13-3 1.52	13-9 1.69	14-2 1.86	14-8 2.04	15-1 2.22	15-6 2.41	15-11 2.60	16-3 2.80	16-8 3.00	17-5 3.42	
		11-6 1.32	11-11 1.46	12-4 1.61	12-8 1.76	13-1 1.92	13-5 2.08	13-9 2.25	14-1 2.42	14-5 2.60	15-1 2.96	
	16.0	9-5 1.08	9-9 1.19	10-0 1.31	10-4 1.44	10-8 1.57	10-11 1.70	11-3 1.84	11-6 1.98	11-9 2.12	12-4 2.41	
		24.0 1.08	9-5 1.19	10-0 1.31	10-4 1.44	10-8 1.57	10-11 1.70	11-3 1.84	11-6 1.98	11-9 2.12	12-4 2.41	
	24.0	17-6 1.52	18-2 1.69	18-9 1.86	19-4 2.04	19-10 2.22	20-5 2.41	20-11 2.60	21-5 2.80	21-11 3.00	22-11 3.42	
		15-2 1.32	15-8 1.46	16-3 1.61	16-9 1.76	17-2 1.92	17-8 2.08	18-2 2.25	18-7 2.42	19-0 2.60	19-10 2.96	
2 x 8	12.0	12-5 1.08	12-10 1.19	13-3 1.31	13-8 1.44	14-0 1.57	14-5 1.70	14-10 1.84	15-2 1.98	15-6 2.12	16-3 2.41	
		24.0 1.08	12-5 1.19	12-10 1.31	13-3 1.44	13-8 1.57	14-0 1.70	14-5 1.84	14-10 1.98	15-2 2.12	15-6 2.41	
	16.0	22-4 1.52	23-2 1.69	23-11 1.86	24-7 2.04	25-4 2.22	26-0 2.41	26-8 2.60	27-4 2.80	28-0 3.00	29-3 3.42	
		19-4 1.32	20-0 1.46	20-8 1.61	21-4 1.76	21-11 1.92	22-6 2.08	23-2 2.25	23-8 2.42	24-3 2.60	25-4 2.96	
	24.0	15-10 1.08	16-4 1.19	16-11 1.31	17-5 1.44	17-11 1.57	18-5 1.70	18-11 1.84	19-4 1.98	19-10 2.12	20-8 2.41	
		27-2 1.52	28-2 1.69	29-1 1.86	29-11 2.04	30-10 2.22	31-8 2.41	32-6 2.60	33-3 2.80	34-1 3.00	35-7 3.42	
2 x 10	12.0	23-6 1.32	24-4 1.46	25-2 1.61	25-11 1.76	26-8 1.92	27-5 2.08	28-2 2.25	28-10 2.42	29-6 2.60	30-10 2.96	
		19-3 24.0	19-11 1.08	20-6 1.19	21-2 1.31	21-9 1.44	22-5 1.57	22-5 1.70	23-0 1.84	23-6 1.98	24-1 2.12	25-2 2.41
	16.0	19-3 1.32	19-11 1.46	20-6 1.61	21-2 1.76	21-9 1.92	22-5 2.08	23-0 2.25	23-6 2.42	24-1 2.60	25-2 2.96	
		19-3 24.0	19-11 1.08	20-6 1.19	21-2 1.31	21-9 1.44	22-5 1.57	22-5 1.70	23-0 1.84	23-6 1.98	24-1 2.12	25-2 2.41
	24.0	22-4 1.08	23-2 1.19	23-11 1.31	24-7 1.44	25-4 1.57	26-0 1.70	26-8 1.84	27-4 1.98	28-0 2.12	29-3 2.41	
		19-4 1.32	20-0 1.46	20-8 1.61	21-4 1.76	21-11 1.92	22-6 2.08	23-2 2.25	23-8 2.42	24-3 2.60	25-4 2.96	
2 x 12	12.0	27-2 1.52	28-2 1.69	29-1 1.86	29-11 2.04	30-10 2.22	31-8 2.41	32-6 2.60	33-3 2.80	34-1 3.00	35-7 3.42	
		23-6 1.32	24-4 1.46	25-2 1.61	25-11 1.76	26-8 1.92	27-5 2.08	28-2 2.25	28-10 2.42	29-6 2.60	30-10 2.96	
	16.0	19-3 24.0	19-11 1.08	20-6 1.19	21-2 1.31	21-9 1.44	22-5 1.57	22-5 1.70	23-0 1.84	23-6 1.98	24-1 2.12	25-2 2.41
		19-3 24.0	19-11 1.08	20-6 1.19	21-2 1.31	21-9 1.44	22-5 1.57	22-5 1.70	23-0 1.84	23-6 1.98	24-1 2.12	25-2 2.41

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For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4i**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**30 Lbs. per Sq. Ft. Live Load (Supporting Veneer Plaster Ceiling)**  
**For Use in Snow Load Zone 2**

**DESIGN CRITERIA:** Strength—10 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)										
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 6	12.0	6-2 0.23	7-1 0.35	7-11 0.49	8-8 0.64	9-5 0.81	10-0 0.99	10-8 1.18	11-3 1.38	11-9 1.59	12-3 1.81	12-10 2.04
		16.0	5-4 0.20	6-2 0.30	6-10 0.42	7-6 0.55	8-2 0.70	8-8 0.85	9-3 1.02	9-9 1.19	10-2 1.38	10-8 1.57
	24.0	4-4 0.16	5-0 0.25	5-7 0.34	6-2 0.45	6-8 0.57	7-1 0.70	7-6 0.83	7-11 0.97	8-4 1.12	8-8 1.28	9-1 1.44
		12.0	8-1 0.23	9-4 0.35	10-6 0.49	11-5 0.64	12-4 0.81	13-3 0.99	14-1 1.18	14-10 1.38	15-6 1.59	16-3 1.81
	2 x 8	16.0	7-0 0.20	8-1 0.30	9-1 0.42	9-11 0.55	10-9 0.70	11-6 0.85	12-2 1.02	12-10 1.19	13-5 1.38	14-0 1.57
		24.0	5-9 0.16	6-7 0.25	7-5 0.34	8-1 0.45	8-9 0.57	9-4 0.70	9-11 0.83	10-6 0.97	11-0 1.12	11-11 1.28
2x 10	12.0	10-4 0.23	11-11 0.35	13-4 0.49	14-8 0.64	15-10 0.81	16-11 0.99	17-11 1.18	18-11 1.38	19-11 1.59	20-8 1.81	21-6 2.04
		16.0	8-11 0.20	10-4 0.30	11-7 0.42	12-8 0.55	13-8 0.70	14-7 0.85	15-6 1.02	16-4 1.19	17-2 1.38	17-11 1.57
	24.0	24.0	7-4 0.16	8-5 0.25	9-5 0.34	10-4 0.45	11-2 0.57	11-11 0.70	12-8 0.83	13-4 0.97	14-0 1.12	14-8 1.28
		12.0	12-7 0.23	14-6 0.35	16-3 0.49	17-10 0.64	19-3 0.81	20-6 0.99	21-9 1.18	23-0 1.38	24-1 1.59	25-2 1.81
	2 x 12	16.0	10-11 0.20	12-7 0.30	14-1 0.42	15-5 0.55	16-8 0.70	17-9 0.85	18-10 1.02	19-11 1.19	20-10 1.38	21-9 1.57
		24.0	8-11 0.16	10-3 0.25	11-6 0.34	12-7 0.45	13-7 0.57	14-6 0.70	15-5 0.83	16-3 0.97	17-0 1.12	17-9 1.28
(inches)	(inches)	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
2 x 6	12.0	13-3 2.29	13-9 2.53	14-3 2.79	14-8 3.06	15-1 3.33	15-6 3.61	15-10 3.90	16-3 4.20	16-8 4.50	17-0 4.81	17-5 5.13
		16.0	11-6 1.98	11-11 2.19	12-4 2.42	12-8 2.65	13-0 2.88	13-5 3.13	13-9 3.38	14-1 3.63	14-5 3.89	14-9 4.16
	24.0	9-4 1.61	9-9 1.79	10-0 1.97	10-4 2.16	10-8 2.35	10-11 2.55	11-3 2.75	11-6 2.96	11-9 3.18	12-0 3.39	12-3 3.62
		12.0	17-6 2.29	18-1 2.53	18-9 2.79	19-3 3.06	19-10 3.33	20-5 3.61	20-11 3.90	21-5 4.20	21-11 4.50	22-5 4.81
	16.0	15-2 1.98	15-8 2.19	16-3 2.42	16-9 2.65	17-3 2.88	17-8 3.13	18-1 3.38	18-7 3.63	19-0 3.89	19-5 4.16	19-10 4.44
		24.0	12-4 1.61	12-10 1.79	13-3 1.97	13-8 2.16	14-0 2.35	14-5 2.55	14-9 2.75	15-2 2.96	15-6 3.18	15-10 3.39
2 x 8	12.0	22-4 2.29	23-1 2.53	23-10 2.79	24-7 3.06	25-4 3.33	26-0 3.61	26-9 3.90	27-4 4.20	28-0 4.50	28-8 4.81	29-3 5.13
		16.0	19-4 1.98	20-0 2.19	20-8 2.42	21-4 2.65	21-11 2.88	22-7 3.13	23-2 3.38	23-9 3.63	24-3 3.89	24-10 4.16
	24.0	15-9 1.61	16-4 1.79	16-10 1.97	17-5 2.16	19-11 2.35	18-5 2.55	18-10 2.75	19-4 2.96	19-10 3.18	20-3 3.39	20-8 3.62
		12.0	27-2 2.29	28-1 2.53	29-1 2.79	29-11 3.06	30-10 3.33	31-8 3.61	32-6 3.90	33-3 4.20	34-1 4.50	34-10 4.81
	16.0	23-6 1.98	24-4 2.19	25-2 2.42	25-11 2.65	26-8 2.88	27-5 3.13	28-2 3.38	28-10 3.63	29-6 3.89	30-2 4.16	30-10 4.44
		24.0	19-2 1.61	19-10 1.79	20-6 1.97	21-2 2.16	21-9 2.35	22-4 2.55	22-11 2.75	23-6 2.96	24-1 3.18	24-7 3.39
2 x 10	12.0	22-4 1.61	23-1 1.79	23-10 1.97	24-7 2.16	25-4 2.35	26-0 2.55	26-9 2.75	27-4 2.96	28-0 3.18	28-8 3.39	29-3 3.62
		16.0	19-4 1.61	20-0 1.79	20-8 1.97	21-4 2.16	21-11 2.35	22-7 2.55	23-2 2.75	23-9 2.96	24-3 3.18	24-10 3.39
	24.0	15-9 1.61	16-4 1.79	16-10 1.97	17-5 2.16	19-11 2.35	18-5 2.55	18-10 2.75	19-4 2.96	19-10 3.18	20-3 3.39	20-8 3.62
		12.0	27-2 1.61	28-1 1.79	29-1 1.97	29-11 2.16	30-10 2.35	31-8 2.55	32-6 2.75	33-3 2.96	34-1 3.18	34-10 3.39
	16.0	23-6 1.61	24-4 1.79	25-2 1.97	25-11 2.16	26-8 2.35	27-5 2.55	28-2 2.75	28-10 2.96	29-6 3.18	30-2 3.39	30-10 3.62
		24.0	19-2 1.61	19-10 1.79	20-6 1.97	21-2 2.16	21-9 2.35	22-4 2.55	22-11 2.75	23-6 2.96	24-1 3.18	24-7 3.39
2 x 12	12.0	22-4 1.61	23-1 1.79	23-10 1.97	24-7 2.16	25-4 2.35	26-0 2.55	26-9 2.75	27-4 2.96	28-0 3.18	28-8 3.39	29-3 3.62
		16.0	19-4 1.61	20-0 1.79	20-8 1.97	21-4 2.16	21-11 2.35	22-7 2.55	23-2 2.75	23-9 2.96	24-3 3.18	24-10 3.39
	24.0	15-9 1.61	16-4 1.79	16-10 1.97	17-5 2.16	19-11 2.35	18-5 2.55	18-10 2.75	19-4 2.96	19-10 3.18	20-3 3.39	20-8 3.62
		12.0	27-2 1.61	28-1 1.79	29-1 1.97	29-11 2.16	30-10 2.35	31-8 2.55	32-6 2.75	33-3 2.96	34-1 3.18	34-10 3.39
	16.0	23-6 1.61	24-4 1.79	25-2 1.97	25-11 2.16	26-8 2.35	27-5 2.55	28-2 2.75	28-10 2.96	29-6 3.18	30-2 3.39	30-10 3.62
		24.0	19-2 1.61	19-10 1.79	20-6 1.97	21-2 2.16	21-9 2.35	22-4 2.55	22-11 2.75	23-6 2.96	24-1 3.18	24-7 3.39

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS  
THE MASSACHUSETTS STATE BUILDING CODE**

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4j**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**30 Lbs. per Sq. Ft. Live Load**  
**For Use in Snow Load Zone 2**

**DESIGN CRITERIA:** Strength—15 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 180.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SPACING AND SIZE		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)											
(inches)	(inches)	200	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 4	12.0	3-0 0.05	3-8 0.09	4-3 0.15	4-9 0.20	5-3 0.27	5-8 0.34	6-0 0.41	6-5 0.49	6-9 0.58	7-1 0.67	7-5 0.76	7-8 0.86
		2-7 0.04	3-2 0.08	3-8 0.13	4-1 0.18	4-6 0.23	4-11 0.29	5-3 0.36	5-6 0.43	5-10 0.50	6-1 0.58	6-5 0.66	6-8 0.74
	16.0	2-2 0.04	2-7 0.07	3-0 0.10	3-4 0.14	3-8 0.19	4-0 0.24	4-3 0.29	4-6 0.35	4-9 0.41	5-0 0.47	5-3 0.54	5-5 0.61
		24.0	4-9 0.05	5-10 0.09	6-8 0.15	7-6 0.20	8-2 0.27	8-10 0.34	9-6 0.41	10-0 0.49	10-7 0.58	11-1 0.67	11-7 0.76
	2x6	4-1 0.04	5-0 0.08	5-10 0.13	6-6 0.18	7-1 0.23	7-8 0.29	8-2 0.36	8-8 0.43	9-2 0.50	9-7 0.58	10-0 0.66	10-5 0.74
		24.0	3-4 0.04	4-1 0.07	4-9 0.10	5-4 0.14	5-10 0.19	6-3 0.24	6-8 0.29	7-1 0.35	7-6 0.41	7-10 0.47	8-2 0.54
	2 x 8	6-3 0.05	7-8 0.09	8-10 0.15	9-10 0.20	10-10 0.27	11-8 0.34	12-6 0.41	13-3 0.49	13-11 0.58	14-8 0.67	15-3 0.76	15-11 0.86
		12.0	5-5 0.04	6-7 0.08	7-8 0.13	8-7 0.18	9-4 0.23	10-1 0.29	10-10 0.36	11-6 0.43	12-1 0.50	12-8 0.58	13-3 0.66
	2 x 10	4-5 0.04	5-5 0.07	6-3 0.10	7-0 0.14	7-8 0.19	8-3 0.24	8-10 0.29	9-4 0.35	9-10 0.41	10-4 0.47	10-10 0.54	11-3 0.61
		24.0	8-0 0.05	9-9 0.09	11-3 0.15	12-7 0.20	13-9 0.27	14-11 0.34	15-11 0.41	16-11 0.49	17-10 0.58	18-8 0.67	19-6 0.76
	2x10	6-11 0.04	8-5 0.08	9-9 0.13	10-11 0.18	11-11 0.23	12-11 0.29	13-9 0.36	14-8 0.43	15-5 0.50	16-2 0.58	16-11 0.66	17-7 0.74
		24.0	5-8 0.04	6-11 0.07	8-0 0.10	8-11 0.14	9-9 0.19	10-6 0.24	11-3 0.29	11-11 0.35	12-7 0.41	13-2 0.47	13-9 0.54
(inches)	(inches)	1400	1500	1600	1700	1800	1900	2000	2100	2200	2400	2700	3000
2 x 4	12.0	8-0 0.96	8-3 1.06	8-6 1.17	8-9 1.28	9-0 1.39	9-3 1.51	9-6 1.63	9-9 1.76	10-0 1.88	10-5 2.15	11-1 2.56	
		6-11 0.83	7-2 0.92	7-5 1.01	7-7 1.11	7-10 1.21	8-0 1.31	8-3 1.41	8-5 1.52	8-8 1.63	9-0 1.86	9-7 2.22	10-1 2.60
	16.0	5-8 0.68	5-10 0.75	6-0 0.83	6-3 0.90	6-5 0.99	6-7 1.07	6-9 1.15	6-11 1.24	7-1 1.33	7-5 1.52	7-10 1.81	8-3 2.12
		24.0	12-6 0.96	13-0 1.06	13-5 1.17	13-10 1.28	14-2 1.39	14-7 1.51	15-0 1.63	15-4 1.76	15-8 1.88	16-5 2.15	17-5 2.56
	16.0	10-10 0.83	11-3 0.92	11-7 1.01	11-11 1.11	12-4 1.21	12-8 1.31	13-0 1.41	13-3 1.52	13-7 1.63	14-2 1.86	15-1 2.22	15-11 2.60
		24.0	8-10 0.68	9-2 0.75	9-6 0.83	9-9 0.90	10-0 0.99	10-4 1.07	10-7 1.15	10-10 1.24	11-1 1.33	11-7 1.52	12-4 1.81
	16.0	16-6 0.96	17-1 1.06	17-8 1.17	18-2 1.28	18-9 1.39	19-3 1.51	19-9 1.63	20-3 1.76	20-8 1.88	21-7 2.15	22-11 2.56	
		14-4 0.83	14-10 0.92	15-3 1.01	15-9 1.11	16-3 1.21	16-8 1.31	17-1 1.41	17-6 1.52	17-11 1.63	18-9 1.86	19-10 2.22	20-11 2.60
	2x8	11-8 0.68	12-1 0.75	12-6 0.83	12-10 0.90	13-3 0.99	13-7 1.07	13-11 1.15	14-4 1.24	14-8 1.33	15-3 1.52	16-3 1.81	17-1 2.12
		24.0	21-1 0.96	21-10 1.06	22-6 1.17	23-3 1.28	23-11 1.39	24-6 1.51	25-2 1.63	25-10 1.76	26-5 1.88	27-7 2.15	29-3 2.56
	16.0	18-3 0.83	18-11 0.92	19-6 1.01	20-1 1.11	20-8 1.21	21-3 1.31	21-10 1.41	22-4 1.52	22-10 1.63	23-11 1.86	25-4 2.22	26-8 2.60
		24.0	14-11 0.68	15-5 0.75	15-11 0.83	16-5 0.90	16-11 0.99	17-4 1.07	17-10 1.15	18-3 1.24	18-8 1.33	19-6 1.52	20-8 1.81

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**

**THE MASSACHUSETTS STATE BUILDING CODE**

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4k**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**30 Lbs. per Sq. Ft. Live Load (Supporting Gypsum Ceiling)**  
**For Use in Snow Load Zone 2**

**DESIGN CRITERIA:** Strength—15 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 240.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)										
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 6	12.0	5-10 0.13	6-8 0.19	7-6 0.27	8-2 0.36	8-10 0.45	9-6 0.55	10-0 0.66	10-7 0.77	11-1 0.89	11-7 1.01	12-1 1.14
		5-0 0.11	5-10 0.17	6-6 0.24	7-1 0.31	7-8 0.39	8-2 0.48	8-8 0.57	9-2 0.67	9-7 0.77	10-0 0.88	10-5 0.99
		4-1 0.09	4-9 0.14	5-4 0.19	5-10 0.25	6-3 0.32	6-8 0.39	7-1 0.46	7-6 0.54	7-10 0.63	8-2 0.72	8-6 0.81
	24.0	7-8 0.09	8-10 0.14	9-10 0.19	10-10 0.25	11-8 0.32	12-6 0.39	13-3 0.46	13-11 0.54	14-8 0.63	15-3 0.72	15-11 0.81
2 x 8	12.0	7-8 0.13	8-10 0.19	9-10 0.27	10-10 0.36	11-8 0.45	12-6 0.55	13-3 0.66	13-11 0.77	14-8 0.89	15-3 1.01	15-11 1.14
		6-7 0.11	7-8 0.17	8-7 0.24	9-4 0.31	10-1 0.39	10-10 0.48	11-6 0.57	12-1 0.67	12-8 0.77	13-3 0.88	13-9 0.99
		5-5 0.09	6-3 0.14	7-0 0.19	7-8 0.25	8-3 0.32	8-10 0.39	9-4 0.46	9-10 0.54	10-4 0.63	10-10 0.72	11-3 0.81
	24.0	9-9 0.09	11-3 0.14	12-7 0.19	13-9 0.27	14-11 0.36	15-11 0.45	16-11 0.55	17-10 0.66	18-8 0.77	19-6 0.89	20-4 1.01
2x 10	12.0	9-9 0.13	11-3 0.19	12-7 0.27	13-9 0.36	14-11 0.45	15-11 0.55	16-11 0.66	17-10 0.77	18-8 0.89	19-6 1.01	20-4 1.14
		8-5 0.11	9-9 0.17	9-9 0.24	10-11 0.31	11-11 0.39	12-11 0.48	13-9 0.57	14-8 0.67	15-5 0.77	16-2 0.88	16-11 0.99
		6-11 0.09	8-0 0.14	8-11 0.19	9-9 0.25	10-6 0.32	11-3 0.39	11-11 0.46	12-7 0.54	13-2 0.63	13-9 0.72	14-4 0.81
	24.0	11-10 0.09	13-8 0.14	15-4 0.19	16-9 0.27	18-1 0.36	19-4 0.45	20-6 0.55	21-8 0.66	22-8 0.77	23-9 0.89	24-8 1.01
2 x 12	12.0	10-3 0.13	11-10 0.19	13-3 0.27	14-6 0.36	15-8 0.45	16-9 0.55	17-9 0.66	18-9 0.77	19-8 0.88	20-6 0.99	21-5 1.14
		16.0 0.11	10-3 0.17	11-10 0.24	13-3 0.31	14-6 0.39	15-8 0.48	16-9 0.57	17-9 0.67	18-9 0.77	19-8 0.88	20-6 0.99
		8-5 0.09	9-8 0.14	10-10 0.19	11-10 0.25	12-10 0.32	13-8 0.39	14-6 0.46	15-4 0.54	16-1 0.63	16-9 0.72	17-5 0.81
(inches)	(inches)	1 400	1500	1600	1700	1800	1900	2000	2100	2200	2400	
2 x 6	12.0	12-6 1.28	13-0 1.41	13-5 1.56	13-10 1.71	14-2 1.86	14-7 2.02	15-0 2.18	15-4 2.34	15-8 2.51	16-5 2.86	
		10-10 1.10	11-3 1.22	11-7 1.35	11-11 1.48	12-4 1.61	12-8 1.75	13-0 1.89	13-3 2.03	13-7 2.18	14-2 2.48	
		24.0 0.90	8-10 1.00	9-2 1.10	9-6 1.21	9-9 1.31	10-0 1.43	10-4 1.54	10-7 1.66	10-10 1.78	11-1 2.02	11-7 2.41
	24.0	16-6 1.28	17-1 1.41	17-8 1.56	18-2 1.71	18-9 1.86	19-3 2.02	19-9 2.18	20-3 2.34	20-8 2.51	21-7 2.86	
2 x 8	12.0	14-4 1.28	14-10 1.41	15-3 1.56	15-9 1.71	16-3 1.86	16-8 2.02	17-1 2.18	17-6 2.34	17-11 2.51	18-9 2.86	
		16.0 1.10	14-4 1.22	14-10 1.35	15-3 1.48	15-9 1.61	16-3 1.75	16-8 1.89	17-1 2.03	17-6 2.18	17-11 2.48	
		24.0 0.90	11-8 1.00	12-1 1.10	12-6 1.21	12-10 1.31	13-3 1.43	13-7 1.54	13-11 1.66	14-4 1.78	14-8 2.02	15-3 2.41
	24.0	21-1 1.28	21-10 1.41	22-6 1.56	23-3 1.71	23-11 1.86	24-6 2.02	25-2 2.18	25-10 2.34	26-5 2.51	27-7 2.86	
2x 10	12.0	18-3 1.10	18-11 1.22	19-6 1.35	20-1 1.48	20-8 1.61	21-3 1.75	21-10 1.89	22-4 2.03	22-10 2.18	23-11 2.48	
		16.0 1.10	14-11 1.00	15-5 1.10	15-11 1.21	16-5 1.31	16-11 1.43	17-4 1.54	17-10 1.66	18-3 1.78	18-8 2.02	19-6 2.41
		24.0 0.90	25-7 1.28	26-6 1.41	27-5 1.56	28-3 1.71	29-1 1.86	29-10 2.02	30-7 2.18	31-4 2.34	32-1 2.51	33-6 2.86
	24.0	22-2 1.10	23-0 1.22	23-9 1.35	24-5 1.48	25-2 1.61	25-10 1.75	26-6 1.89	27-2 2.03	27-10 2.18	29-1 2.48	
2 x 12	24.0	18-1 0.90	18-9 1.00	19-4 1.10	20-0 1.21	20-6 1.31	21-1 1.43	21-8 1.54	22-2 1.66	22-8 1.78	23-9 2.02	25-2 2.41

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**

**THE MASSACHUSETTS STATE BUILDING CODE**

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.  
NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

**780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS**  
**ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION**

**TABLE 3608.2.4I**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**  
**30 Lbs. per Sq. Ft. Live Load (Supporting Plaster Ceiling)**  
**For Use in Snow Load Zone 2**

**DESIGN CRITERIA:** Strength—15 lbs. per sq ft. dead load plus 30 lbs. per sq.ft. live load determines fiber stress.  
 Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.  
**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)									
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200
2 x 6	12.0	5-10 0.19	6-8 0.29	7-6 0.41	8-2 0.54	8-10 0.68	9-6 0.83	10-0 0.99	10-7 1.15	11-1 1.33	11-7 1.52
		5-0 0.16	5-10 0.25	6-6 0.35	7-1 0.46	7-8 0.59	8-2 0.72	8-8 0.85	9-2 1.00	9-7 1.15	10-0 1.31
	24.0	4-1 0.13	4-9 0.21	5-4 0.29	5-10 0.38	6-3 0.48	6-8 0.58	7-1 0.70	7-6 0.82	7-10 0.94	8-2 1.07
		7-8 0.19	8-10 0.29	9-10 0.41	10-10 0.54	11-8 0.68	12-6 0.83	13-3 0.99	13-11 1.15	14-8 1.33	15-3 1.52
	16.0	6-7 0.16	7-8 0.25	8-7 0.35	9-4 0.46	10-1 0.59	10-10 0.72	11-6 0.85	12-1 1.00	12-8 1.15	13-3 1.31
		5-5 0.13	6-3 0.21	7-0 0.29	7-8 0.38	8-3 0.48	8-10 0.58	9-4 0.70	9-10 0.82	10-4 0.94	10-10 1.07
	2 x 8	9-9 0.19	11-3 0.29	12-7 0.41	13-9 0.54	14-11 0.68	15-11 0.83	16-11 0.99	17-10 1.15	18-8 1.33	19-6 1.52
		8-5 0.16	9-9 0.25	10-11 0.35	11-11 0.46	12-11 0.59	13-9 0.72	14-8 0.85	15-5 1.00	16-2 1.15	16-11 1.31
	24.0	6-11 0.13	8-0 0.21	8-11 0.29	9-9 0.38	10-6 0.48	11-3 0.58	11-11 0.70	12-7 0.82	13-2 0.94	13-9 1.07
		11-10 0.19	13-8 0.29	15-4 0.41	16-9 0.54	18-1 0.68	19-4 0.83	20-6 0.99	21-8 1.15	22-8 1.33	23-9 1.52
2x 12	16.0	10-3 0.16	11-10 0.25	13-3 0.35	14-6 0.46	15-8 0.59	16-9 0.72	17-9 0.85	18-9 1.00	19-8 1.15	20-6 1.31
		8-5 0.13	9-8 0.21	10-10 0.29	11-10 0.38	12-10 0.48	13-8 0.58	14-6 0.70	15-4 0.82	16-1 0.94	16-9 1.07
	24.0	12.0	1.71	12-6 1.91	13-0 2.12	13-5 2.34	13-10 2.56	14-1 2.79	14-6 3.02	15-0 3.27	15-4 3.51
		16.0	1.48	10-5 1.66	11-3 1.84	11-7 2.02	11-11 2.22	12-4 2.41	12-8 2.62	12-11 2.82	13-3 3.04
2 x 6	24.0	8-6 1.21	8-10 1.35	9-2 1.50	9-6 1.65	9-9 1.81	10-0 1.97	10-4 2.14	10-7 2.31	10-10 2.48	11-1 2.66
		12.0	1.71	15-11 1.91	16-6 2.12	17-1 2.34	17-8 2.56	18-2 2.79	18-8 3.02	19-3 3.27	19-9 3.51
		16.0	1.48	13-9 1.66	14-4 1.84	14-10 2.02	15-3 2.22	15-9 2.41	16-3 2.62	16-8 2.83	17-1 3.04
		24.0	1.21	11-3 1.35	11-8 1.50	12-1 1.65	12-6 1.81	12-10 1.97	13-3 2.14	13-7 2.31	13-11 2.48
	2 x 8	12.0	1.71	17-7 1.91	18-3 2.12	18-11 2.34	19-6 2.56	20-1 2.79	20-8 3.02	21-3 3.27	21-9 3.51
		16.0	1.48	17-9 1.66	14-4 1.84	14-10 2.02	15-3 2.22	15-9 2.41	16-3 2.62	16-8 2.83	17-1 3.04
		24.0	1.21	14-4 1.35	14-11 1.50	15-5 1.65	15-11 1.81	16-5 1.97	16-11 2.14	17-4 2.31	17-10 2.48
		12.0	1.71	20-4 1.91	21-1 2.12	21-10 2.34	22-6 2.56	23-3 2.79	23-10 3.02	24-6 3.27	25-2 3.51
2 x 10	24.0	16.0	1.48	17-7 1.66	18-3 1.84	18-11 2.02	19-6 2.22	20-1 2.41	20-8 2.62	21-3 2.83	21-9 3.04
		24.0	1.21	14-4 1.35	14-11 1.50	15-5 1.65	15-11 1.81	16-5 1.97	16-11 2.14	17-4 2.31	17-10 2.48
		12.0	1.71	24-8 1.91	25-7 2.12	26-6 2.34	27-5 2.56	28-3 2.79	29-1 3.02	29-10 3.27	30-7 3.51
	2 x 12	16.0	1.48	21-5 1.66	22-2 1.84	23-0 2.02	23-9 2.22	24-5 2.41	25-2 2.62	25-10 2.83	26-6 3.04
		24.0	1.21	17-5 1.21	18-1 1.35	18-9 1.50	19-4 1.65	20-0 1.81	20-6 1.97	21-1 2.14	21-8 2.31
		12.0	1.71	24-8 1.91	25-7 2.12	26-6 2.34	27-5 2.56	28-3 2.79	29-1 3.02	29-10 3.27	30-7 3.51

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**THE MASSACHUSETTS STATE BUILDING CODE**

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown below each span.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS  
ONE AND TWO FAMILY DWELLINGS - ROOF-CEILING CONSTRUCTION

**TABLE 3608.2.4m**  
**ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS**

**35 Lbs. per Sq. Ft. Live Load**  
**For Use in Snow Load Zone 3**

**DESIGN CRITERIA:** Strength-35 lbs. per sq. ft. live load plus 10 lbs. per sq. ft. dead load determines fiber stress.

Deflection—For 35 lbs. per sq. ft. live load. Limited to span in inches divided by 180.

**RAFTERS:** Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

**HOW TO USE TABLES:** Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "F <sub>b</sub> ," (psi)										
(inches)	(inches)	300	400	500	600	700	800	900	1000	1100	1200	
2 x 6	12.0	5-10 .11	6-8 .17	7-6 .24	8-2 .31	8-10 .39	9-6 .48	10-0 .58	10-7 .67	11-1 .78	11-7 .89	
		5-0 .10	5-10 .15	6-6 .21	7-1 .27	7-8 .34	8-2 .42	8-8 .50	9-2 .58	9-7 .67	10-0 .77	
	24.0	4-1 .08	4-9 .12	5-4 .17	5-10 .22	6-3 .28	6-8 .34	7-1 .41	7-6 .48	7-10 .55	8-2 .63	
		7-8 .11	8-10 .17	9-10 .24	10-10 .31	11-8 .39	12-6 .48	13-3 .58	13-11 .67	14-8 .78	15-3 .89	
	12.0	6-7 .10	7-8 .15	8-7 .21	9-4 .27	10-1 .34	10-10 .42	11-6 .50	12-1 .58	12-8 .67	13-3 .77	
		16.0 .10	16.0 .15	16.0 .21	16.0 .27	16.0 .34	16.0 .42	16.0 .50	16.0 .58	16.0 .67	16.0 .77	
	24.0	5-5 .08	6-3 .12	7-0 .17	7-8 .22	8-3 .28	8-10 .34	9-4 .41	9-10 .48	10-4 .55	10-10 .63	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	
	12.0	9-9 .11	11-3 .17	12-7 .24	13-9 .31	14-11 .39	15-11 .48	16-11 .58	17-10 .67	18-8 .78	19-6 .89	
		8-5 .10	9-9 .15	10-11 .21	11-11 .27	12-11 .34	13-9 .42	14-8 .50	15-5 .58	16-2 .67	16-11 .77	
	24.0	6-11 .08	8-0 .12	8-11 .17	9-9 .22	10-6 .28	11-3 .34	11-11 .41	12-7 .48	13-2 .55	13-9 .63	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	
2 x 8	12.0	11-10 0.11	13-8 0.17	15-4 0.24	16-9 0.31	18-1 0.39	19-4 0.48	20-6 0.58	21-8 0.67	22-9 0.78	23-9 0.89	
		16.0 .10	16.0 .15	16.0 .21	16.0 .27	16.0 .34	16.0 .42	16.0 .50	16.0 .58	16.0 .67	16.0 .77	
	24.0	10-3 0.08	11-10 0.12	13-3 0.17	14-6 0.22	15-8 0.28	16-9 0.34	17-8 0.42	18-9 0.58	19-8 0.67	20-6 0.77	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	
	(inches)		<b>1300</b>	<b>1400</b>	<b>1500</b>	<b>1600</b>	<b>1700</b>	<b>1800</b>	<b>1900</b>	<b>2000</b>	<b>2100</b>	<b>2200</b>
	12.0	12-1 1.00	12-6 1.12	13-0 1.24	13-5 1.36	13-10 1.49	14-2 1.63	14-7 1.76	15-0 1.91	15-4 2.05	15-9 2.2	
		16.0 .86	16.0 .97	16.0 1.07	16.0 1.18	16.0 1.29	16.0 1.41	16.0 1.53	16.0 1.65	16.0 1.78	16.0 1.90	
	24.0	8-6 .71	8-10 .79	9-2 .88	9-6 .96	9-9 1.06	10-0 1.15	10-4 1.25	10-7 1.35	10-10 1.45	11-1 1.55	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	
	12.0	15-11 1.00	16-6 1.12	17-1 1.24	17-8 1.36	18-2 1.49	18-9 1.63	19-3 1.76	19-9 1.91	20-3 2.05	20-8 2.20	
		16.0 .86	16.0 .97	16.0 1.07	16.0 1.18	16.0 1.29	16.0 1.41	16.0 1.53	16.0 1.65	16.0 1.78	16.0 1.90	
	24.0	11-3 .71	11-8 .79	12-1 .88	12-6 .96	12-10 1.06	13-3 1.15	13-7 1.25	13-11 1.35	14-4 1.45	14-8 1.55	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	
2 x 10	12.0	20-4 1.00	21-1 1.12	21-10 1.24	22-6 1.36	23-3 1.49	23-11 1.63	24-6 1.76	25-2 1.91	25-10 2.05	26-5 2.20	
		16.0 .86	16.0 .97	16.0 1.07	16.0 1.18	16.0 1.29	16.0 1.41	16.0 1.53	16.0 1.65	16.0 1.78	16.0 1.90	
	24.0	14-4 .71	14-11 .79	15-5 .88	15-11 .96	16-5 1.06	16-11 1.15	17-4 1.25	17-10 1.35	18-3 1.45	18-8 1.55	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	
	12.0	24-8 1.00	25-7 2.2	26-6 1.24	27-4 1.36	28-3 1.49	29-1 1.63	29-10 1.76	30-7 1.91	31-4 2.05	21-1 2.20	
		16.0 .86	16.0 .97	16.0 1.07	16.0 1.18	16.0 1.29	16.0 1.41	16.0 1.53	16.0 1.65	16.0 1.78	16.0 1.90	
	24.0	17-5 0.71	17-9 0.79	18-9 0.87	19-4 0.96	19-11 1.06	20-6 1.15	21-2 1.25	21-8 1.35	22.2 1.45	22-9 1.55	
		24.0 .08	24.0 .12	24.0 .17	24.0 .22	24.0 .28	24.0 .34	24.0 .41	24.0 .48	24.0 .55	24.0 .63	

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